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THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

AGRICULTURAL RESEARCH ADMINISTRATION

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

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STUDIES OF THE BREAKDOWN OF DISODIUM ETHYLENE BISDITHIOCARBAMATE (NABAM)

R. A. Ludwig and G. D. Thorn

Despite the continued interest in the fungicidal action of nabam and its derivatives, the course of breakdown of this compound has never been established. It is generally agreed, however, that the mechanism of action of nabam cannot be explained entirely by the activity of the nabam molecule itself. Parker-Rhodes (2) in 1943 suggested that the activity of the alkyldithiocarbamates was associated with two reactions, one involving CS_2, the other involving the amine. His experimental evidence, however, showed that both CS_2 and the dialkyl amines have a rather low level of fungicidal activity. Barrett and Horsfall (1) suggested that the toxicity of nabam might be due to both the formation of H_2S and the formation of metallic bisdithiocarbamates. They present three hypothetical equations showing how H_2S might be produced. Ethylene thiourea was positively identified as a breakdown product. The formation of CS_2 was postulated but not demonstrated experimentally. Neither ethylene thiourea or CS_2, however, showed sufficient activity to account for the behavior of nabam. Van der Kerk and Klöpping (3) compared nabam and a number of selected compounds using an agar technique. They concluded that the fungicidal activity of nabam might be explained by the formation of isothiocyanates but presented no direct evidence of the occurrence of these substances in nabam solutions.

In the course of preliminary studies it was observed that a yellow, crystalline, relatively water-insoluble precipitate, of high fungitoxicity, developed in a 1000 p.p.m. solution of chemically-pure nabam on standing for 44 days. This or a similar material was also observed occasionally in the spore germination droplets. No germination was observed in droplets containing the yellow crystals. On following this lead it was found that a yellow, more or less amorphous, mixed precipitate developed on the vigorous aeration of dilute (1000 p.p.m.) nabam solutions. This material also showed a relatively high order of fungitoxicity and appeared as though it might explain the fungicidal activity of nabam.

In order to obtain a sufficient quantity of this material for further study a large volume of nabam solution was aerated in ten-gallon earthenware crocks. The aerators consisted of long coils of rubber tubing, in which numerous fine perforations had been made, attached to heavy glass rods in the bottom of the crocks. Air was forced through from the laboratory air line. Thirty litres of a 1000 p.p.m. nabam solution diluted from a commercial preparation was aerated in each crock. The length of aeration required to bring the reaction to completion varied somewhat between runs. Usually a period of five days was adequate. The odour of H_2S was very strong on initiation of aeration, but disappeared within the first hour, after which no further gas evolution could be detected by smell. The yields obtained on successive runs varied somewhat but were usually about 33 percent of the original weight of nabam. The precipitates obtained showed a relatively high order of fungitoxicity, but were somewhat less potent than solutions of nabam itself. Considerable potency remained in the mother liquor.

The mother liquor was selected for initial chemical study. It was shown to contain ethylene thiourea, confirming Barrett and Horsfall's observations. A second organic component was identified as ethylene thiuram monosulphide, not previously mentioned in the literature (Calc. for $C_4H_6N_2S_3$: C, 27.0; H, 3.37; S, 53.9; N, 15.7%; mol. wt. 178. Found: C, 27.3; H, 2.97; S, 54.8; N, 15.4%; mol. wt. 162). When tested against Sclerotinia fructicola by the spore drop assay technique, this material was found to have an E.D. 50 value of 1.5 p.p.m. Solutions of ethylene thiuram monosulphide showed an ultraviolet absorption peak of 280 mμ. The diagram presented in Figure 1 shows the relationship between the height of this peak and the E.D. 50 values of a number of separate filtrates. An excellent correlation is evident.

Analysis of the residues showed them to contain about 62 percent sulphur. They contained about 15 percent elementary sulphur and between 10 and 20 percent ethylene thiuram monosulphide. The results of elementary analysis indicate that the balance may be polyethylene thiuram monosulphide.

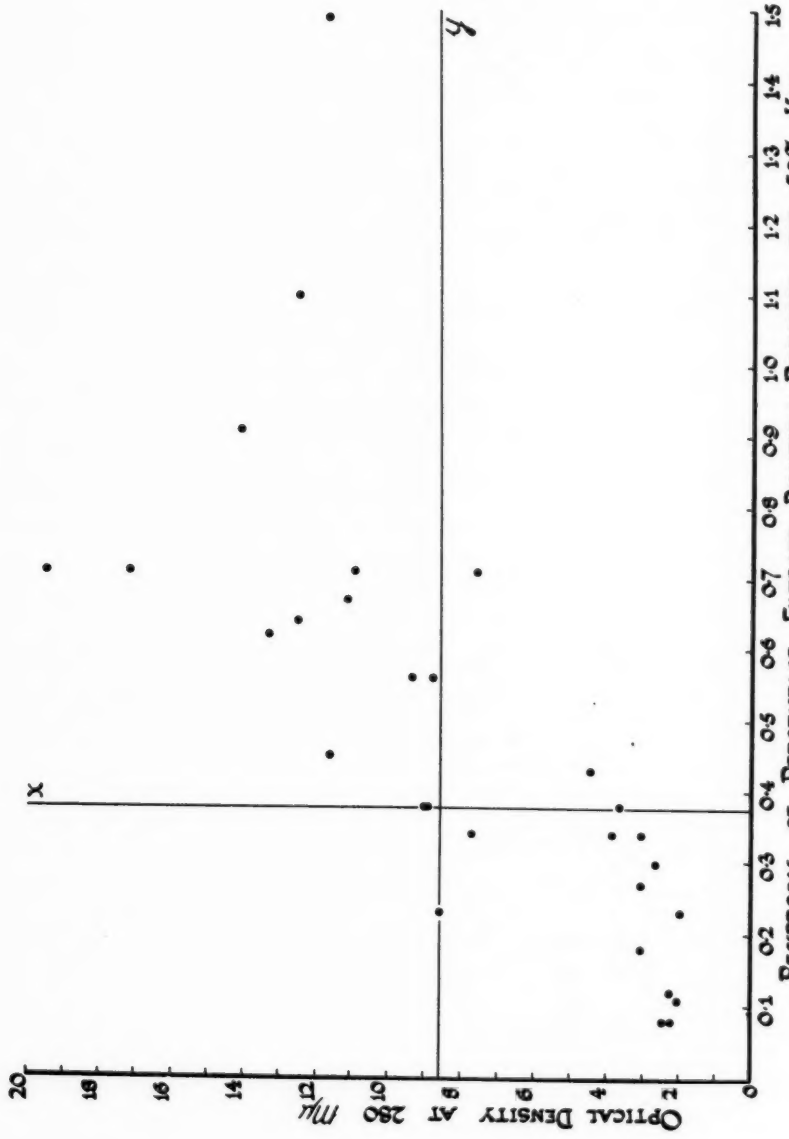

FIGURE 1. Scatter diagram showing the relationship between ethylene thiuram monosulphide content and fungicidal activity of filtrates obtained by aerating nabam solutions.

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FURTHER OBSERVATIONS ON BLACK ROOT ROT OF COTTON IN THE UPPER RIO GRANDE VALLEY OF TEXAS AND NEW MEXICO

P. J. Leyendecker, Jr., L. M. Blank, and R. M. Nakayama

In 1951 black root rot of cotton, caused by Thielaviopsis basicola (Berk. & Br.) Ferraris, was reported from two fields in the upper Rio Grande Valley of Texas (1). During 1952 the disease has been discovered in ten additional fields in Texas and New Mexico. The location of the fields from which diseased plants were collected and the causal agent isolated are shown in Figure 1. The area in which the disease was found extends along the Rio Grande Valley of west Texas and New Mexico for approximately 75 miles. A more complete survey undoubtedly would have provided additional locations within the present range of the disease in the two States. All ten fields in which the disease was observed were planted to Pima 32, an American-Egyptian variety of long-staple cotton (Gossypium barbadense). The organism was isolated also from an Upland cotton plant (G. hirsutum) found in one of these fields.

Invariably, black root rot was found on light, sandy soil (Anthony sandy loam) associated with root galling caused by the root knot nematode Meloidogyne sp. The amount of nematode root damage on diseased plants varied from an occasional gall to moderately severe galling. Black root rot was not found on the more common heavy alluvial soil (Gila clay) where the root knot nematode is very seldom found on cotton. The repeated association of Thielaviopsis and the root knot nematode suggests more than a mere chance relationship.

Above-ground symptoms of black root rot in 1952 were first observed in late June, when the cotton plants were approximately 75 days old. Figure 2 shows the typical wilting and collapse of the leaves and young stem tissues. The collapse was so rapid that the wilted leaves and young squares did not fall off and many affected plants exhibited symptoms similar to those caused by lightning. When the crown and roots of the infected plants were split longitudinally, they showed a limited amount of brownish flecking in the woody tissue without appreciable crown swelling. Externally, the bark on the main tap and lateral roots appeared normal. When the bark was removed from the diseased root and crown, a light tan discoloration of the cambium was noted. It is unusual to find such limited internal symptoms associated with the severe collapse and wilting of the leaves and succulent stem tissues. Formation of lateral stems at the cotyledonary node usually followed in two or three weeks. This sprouting was not seen when the plants were attacked late in the season.

Late-season examination of diseased plants frequently revealed an internal discoloration of the stele and swelling of the crown. Figure 3, B and C, shows the late-season symptoms previously described as typical of black root rot, in Arizona (2) and in Peru (3). These workers made no mention of the sparse internal symptoms associated with early season wilting and collapse of succulent stem tissues, as noted in Texas and New Mexico. Most diseased plants late in the season are characterized by prominent reddish-brown lenticels, pronounced crown swelling, and a purplish-brown discoloration of the stele. As mentioned previously, these characteristic symptoms so common late in the season are seldom found associated with the collapse of the above-ground parts in June and July. Figure 3 (A) also shows a black, firm, dry rot of the cortex apparently caused by Thielaviopsis under field conditions. Woody tissues contiguous to the diseased cortical tissue were purplish-brown in color, and in free-hand sections they contained numerous chlamydospores characteristic of the pathogen.

Black root rot appeared in most instances following an irrigation, when soil temperatures dropped and the available soil moisture was high. The disease was especially severe in low areas in fields where water stood for a considerable length of time. In most fields the infested areas were scattered and involved only a small portion of the over-all acreage. In two fields approximately one-third of the acreage was severely infested, and undoubtedly the disease resulted in some reduction in yield of seed cotton. However, at present the disease does not appear to be a serious threat to the production of American-Egyptian cotton in New Mexico and Texas.

It seems evident that Thielaviopsis is indigenous to the area in which it has been found on cotton in New Mexico and Texas. The expanded range for black root rot of cotton can possibly be attributed to two factors, namely the increased acreage of American Egyptian cotton, and the awareness of its presence in the area.

FIGURE 1. MAP OF THE UPPER RIO GRANDE VALLEY OF TEXAS AND NEW MEXICO SHOWING DISTRIBUTION OF BLACK ROOT ROT OF COTTON (THIELAVIOPSIS BASICOLA). EACH DOT REPRESENTS A FIELD OF AMERICAN-EGYPTIAN COTTON (PIMA 32) WHERE DISEASED PLANTS WERE COLLECTED AND THE CAUSAL AGENT ISOLATED.

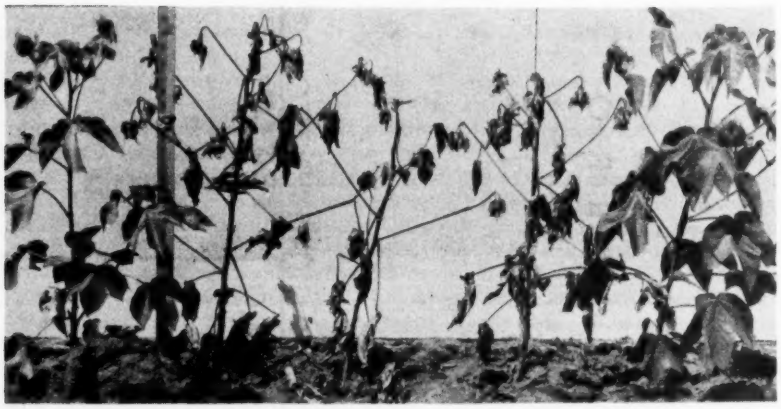

FIGURE 2. Symptoms of black root rot on long staple cotton (Pima 32). Note complete collapse and wilting of the leaves and succulent stem tissue. The dead leaves usually remain attached to the diseased plants. Plants are approximately 75 days old.

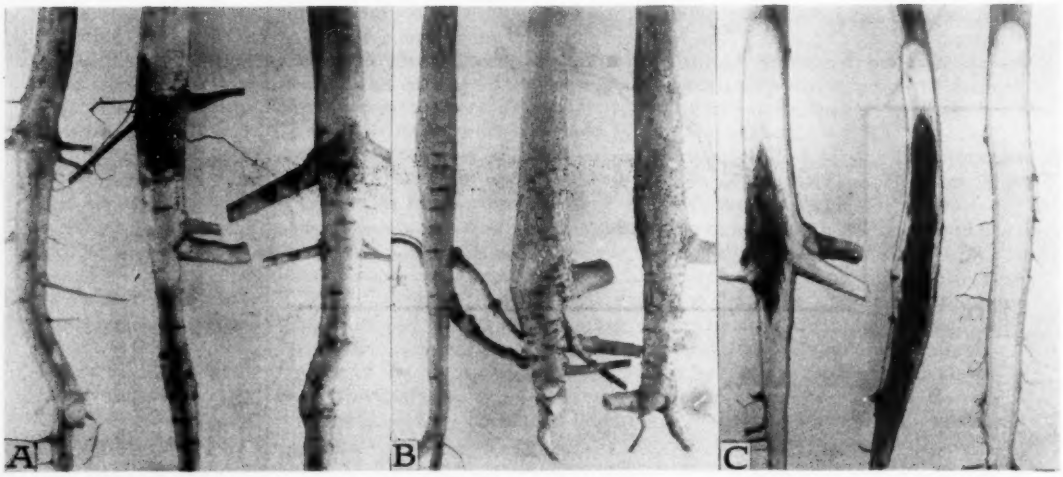

FIGURE 3. Black root rot of cotton (Pima 32) caused by (Thielaviopsis basicola). A. Two roots showing a black, dry rot of the cortex. Root at left is healthy. B. Three cotton roots showing enlarged crowns and prominent lenticels. C. Longitudinal sections of the diseased roots showing purplish-brown discoloration of the stele. Root at right is healthy.

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CONTRIBUTION NO. 78 FROM THE NEW MEXICO AGRICULTURAL EXPERIMENT STATION, DEPARTMENT OF BIOLOGY, STATE COLLEGE, NEW MEXICO, AND DIVISION OF COTTON AND OTHER FIBER CROPS AND DISEASES, U. S. BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING.

LETTUCE MOSAIC IN THE IMPERIAL AND YUMA VALLEYS[1]

G. W. Bohn[2], Robert E. Foster[3], and Thomas W. Whitaker[2]

Mosaic caused important losses in the late fall and early winter crops of lettuce in the Imperial Valley, California, and the Yuma Valley, Arizona, during the 1952-53 growing season. The present report is a record of the severity of the disease in these areas, together with some observations on conditions that may have contributed to the outbreaks.

Lettuce mosaic has been observed in commercial fields and experimental plots in these inland valleys for many years. Prior to 1952 it seldom caused important losses[5]. Small losses, 1 to 3 percent, often resulted from use of infected seed. Secondary infection was at a minimum because the crop was grown during the cool winter months, when temperatures and other conditions were unfavorable for aphid build-up and movement.

Observations in commercial fields in the Imperial Valley in late November and early December, 1952, indicated that mosaic was much more prevalent than usual. The proportions of infected plants varied greatly in different fields. No secondary spread was observed in a field well-isolated from cotton and other field crops and in fields of spring lettuce planted in November. Sporadic plants diseased as a result of use of infected seed were observed in all of these fields. Mosaic plants were most abundant in fields planted in late September and October for late fall and early winter harvest and located in the center of the cropping area. In some of these fields 25 to 50 percent of the plants were mosaic-infected.

Symptoms were more severe in plants attacked while young. These were often stunted and distorted. Head formation and growth were delayed. Plants attacked as the heads matured were less severely injured and often showed mild symptoms. Necrosis was not observed while the temperatures remained high but became severe after the first frost.

Mosaic was prevalent in the Yuma Valley during this same period, infection approaching 100 percent in certain fields. Some fields were so severely damaged by the disease that they were abandoned before harvest. Symptoms were more severe in fields planted for winter harvest than in earlier fields. The difference apparently resulted from differences in stage of growth at the time of infection. Non-thinned fields planted during November for spring harvest contained mosaic plants as a result of use of infected seed, but they were apparently free of secondary infection.

The unusual prevalence of lettuce mosaic in late fall and early winter lettuce in the Imperial and Yuma Valleys during the 1952-53 season appeared to be correlated with an unusual abundance of aphids and other insects during October and early November. Temperatures averaged about 10° F above normal during this period. It is probable that these unseasonably high temperatures were an important contributing factor in the build-up and activity of the insect population during the fall.

Our observations suggest that all the commercial varieties of lettuce grown for fall and winter culture in the areas under observation are equally susceptible to the disease. Likewise, there were no consistent differences in the amount of infection when fields planted with seed from different sources were compared.

Grogan, Welch, and Bardin[4, 5] offered convincing proof that lettuce mosaic can be controlled by planting mosaic-free seed. If losses from lettuce mosaic continue to be severe in crops planted for fall and early winter harvest, it may be economical for growers and seedsmen to consider a program for producing mosaic-free seed.

DIVISION OF VEGETABLE CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE, LA JOLLA, CALIFORNIA, AND DEPARTMENT OF HORTICULTURE, UNIVERSITY OF ARIZONA, TUSCON, ARIZONA.

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[1]The authors wish to acknowledge the assistance of the following members of the Staff of the University of Arizona for help in making the surveys: A. R. Face, Lemac Hopkins, Robert B. Marlatt, Frank Pritchard, Ivan Shields, Theodore Siek, and C. W. Van Horn.

[2]Plant Pathologist and geneticist, respectively, U.S.B.P.I.S.A.E.

[3]Horticulturist, Arizona Agricultural Experiment Station.

[4]Grogan, R. G., J. E. Welch, and Roy Bardin. 1952. Common lettuce mosaic control. Calif. Agr. 6 (8): 5, 14.

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PERITHECIA OF ERYSIPHE CICHORACEARUM ON LETTUCE IN THE FIELD

Josue A. Deslandes[1], Roy Bardin[2], and W. C. Snyder[3]

The occurrence of Erysiphe cichoracearum D. C. on cultivated lettuce (Lactuca sativa L.) in the field has been reported in California for the years 1940[4] and 1951[5]. In both reports the uniqueness in these sudden appearances of the disease, and its disappearance between 1940 and 1951, were commented upon. Furthermore, only the conidial stage of the fungus was found, never perithecia, although the ascigerous stage was searched for and is found not uncommonly on wild lettuce (Lactuca scariola L.). However, the fungus on wild lettuce was shown by Pryor[4] not to infect the ordinary varieties of cultivated lettuce. The field occurrence reported by him was limited to a hybrid between wild and cultivated lettuce planted in an experimental plot in the Salinas Valley, and is believed to have been caused by the biological race or races naturally occurring on wild lettuce.

The 1951 outbreak, on the other hand, seemed to reflect the origination of an entirely new biological race adapted to the common commercial varieties of cultivated lettuce.

In view of these facts it seems of unusual interest that in October of 1952 not only was powdery mildew again found in the Salinas Valley, in the same districts reported upon by Snyder et al.[5], but that this time perithecia were found, in abundance, on the Great Lakes variety. It seems highly significant that the disease now has appeared in two consecutive years and this time with both conidial and perithecial fructifications. One is led to conclude that a race or races of the fungus have arisen that are well adapted to pathogenesis in cultivated lettuce, in that area. It would also appear from this consecutive occurrence, and the appearance of the perithecial stage, that there may be reason to expect powdery mildew of lettuce to become more frequent hereafter than in the past.

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[3]Professor of Plant Pathology and Plant Pathologist, University of California, Berkeley, California.
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HOSTS OF THE BRANCHED BROOMRAPE AND ITS OCCURRENCE IN CALIFORNIA

Richard D. Durbin[1]

The branched broomrape, Orobanche ramosa L., a parasitic angiosperm, appeared in tomato fields near Centerville, California, in 1929 (1), 1934 (6), and again in 1951-52. Since the initial report of this parasite in 1929, considerable spread has occurred. An unreported outbreak in 1942 just two miles from the focal point of 1929, and one five miles away in 1952, were attributed to the movement of seed-infested soil on farm implements. Winter floods, which have occurred in this area since 1950, are also believed to have been of considerable importance in spreading seed.

The branched broomrape is a parasitic annual which attacks plant roots. It is devoid of chlorophyll and bears bract-like leaves, true flowers, and seed. Seed is produced in tremendous quantities and appears to germinate only when in close proximity to suitable host roots. Seed is reported to remain viable in the soil for as long as 13 years (4). Immediately after germination the radicle of the broomrape attaches itself to a host root. At the point of attachment a small nodule is produced, from which tentacle-like roots and ultimately shoots arise. Shoots usually attain a height of four to ten inches and bear purplish-white flowers.

Parasitized tomato plants show evidence of stunting, reduced vitality, and poor yields. However, the full effects of the root parasite on the hosts are not known. In hemp the quality of fiber has been shown to be greatly reduced (4). Severe injury depends largely upon an early attack in the life of the host.

This broomrape was probably first introduced into this country from the Orient early in the 19th century as a seed contaminant of hemp (3). It was first reported in Kentucky (3), then Illinois (4) on hemp. Subsequent to 1895 it appeared in Wisconsin on hemp (8, p. 420), in Ohio on tobacco and occasionally in other areas where tobacco is grown (7, p. 286).

The economic plants most commonly affected are: tomato, Lycopersicon esculentum Mill.; hemp, Cannabis sativa L.; tobacco, Nicotiana tabacum L.; and Taraxacum kok-saghyz Rodin (5).

The following additional hosts have been reported (2, p. 67; 4): Armoracia lapathaefolia Gilib., Begonia semperflorens Link & Otto, Brassica napus L., Brassica oleracea L. var. capitata L., Brassica rapa L., Coleus sp., Cuphea platycentra Benth., Eupatorium ligustrinum DC., Heliotropium peruvianum L., Lamium album L., Lamium maculatum L., Lamium purpureum L., Lepidium virginicum L., Leucas martinicensis R. Br., Solanum (Nicotiana) pseudocapsicum L., Pelargonium zonale Willd., Pelargonium sp., Pentstemon gentianoides Poir., Perilla nankinensis Hort., Petunia hybrida Hort., Salvia coccinea Juss., Salvia splendens Sello, Tropaeolum majus L., Veronica sp., Vitis vinifera L., Xanthium macrocarpum DC., and Xanthium spinosum L.

In the literature some doubt has been expressed about the following list of host plants, either as to positive identity of the host or of the broomrape species involved. They are best considered as doubtful hosts (2, p. 67-68): Ammi visnage Lam., Archangelica officinalis Hoffm., Coleus blumei Benth., Daucus carota L., Dianthus caryophyllus L., Dracocephalum moldavica L., Fagopyrum sagittatum Gilib., Galeopsis ladanum L., Galium tricorne Stok., Geranium pusillum Burm., Helianthus annuus L., Humulus lupulus L., Lactuca perennis L., Matricaria partheniodes Desf., Melilotus officinalis (L.) Lam., Nicotiana glauca Grah., Nicotiana latissima Mill., Nicotiana rustica L., Oenothera acaulis Cav., Pastinaca sativa L., Pastinaca sp., Pelargonium hybridum Ait., Polygonum aviculare L., Primula sinensis Lindl., Pyrethrum indicum Cass., Pyrethrum sp., Solanum jasminoides Paxt., Solanum nigrum L., Solanum tuberosum L., Trifolium pratense L., Verbena chamaedryfolia Juss., Verbesina encelioides (Cav.) Benth. & Hook., and Zea mays L.

In California branched broomrape was observed in 1952 growing on several hosts not reported previously, namely: Amaranthus retroflexus L., Capsella bursa-pastoris (L.) Medic., and Solanum sarachoides Sendt. In each instance an actual root attachment to the host was observed and photographed (Fig. 1 and 2). It was found on Conium maculatum L., listed previously as a doubtful host (2, p. 68), and on Xanthium spinosum L., an old reported host. Inasmuch as the infected weed hosts were present only in heavily parasitized tomato fields it is possible that the main stimulus for germination of the broomrape and some nutritional support were derived from tomato.

[1]The writer is grateful for kind assistance given by S. Wilhelm, C. E. Scott, University of California, W. M. Shrader, Deputy Agricultural Commissioner, Alameda County, and L. C. Benson, County Director of Agricultural Extension, Alameda County, California.

FIGURE 1. Orobanche ramosa L. on Amaranthus retroflexus L. and Capsella bursa-pastoris (L.) Medic.

FIGURE 2. Orobanche ramosa L. on Solanum sarachoides Sendt.

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THE MASS PRODUCTION OF BLIGHT-RESISTANT CORN[1]

C. C. Wernham[2]

For resistance to Helminthosporium turcicum, crosses made between very resistant lines with a rating of 0.5 or 1.0 and very susceptible lines with a rating of 5.0 yield in the F_2 about 1 plant per 1000 of a rating of 0.5 or 1 and 2.3 plants of an acceptable rating of 2.0 (3). Under our conditions we cannot detect the desirable plants until September 15 or later. This means that most of the nursery is discarded. There should be a more productive method of producing blight-resistant corn (maize).

Certain cultures turned over to the agronomists for 1949 top-crossing were planted for yield test in 1950. This meant that by 1951 there would be available for second cycle breeding some blight-resistant lines from the 1950 test. These could be used in 3-way crosses of the type (R x S) R^1.

For the (R x S) crosses, (C103 x 40B), C103, and two of our resistant lines of the origin M14 x K155 and (Oh04 x NC34) A71, were used as resistant parents, with the susceptible lines I205, W23, I11A, Os420, WF9, L317, Oh28, and Oh26. The H. turcicum-resistant parents are also quite resistant to H. maydis. The following crosses and some reciprocal crosses were made, constituting the (R x S) group.

1. (C103 x 40B) (R x S)	2. C103 (R)	3. M14 x K155 (R)	4. (Oh04 x Nc34) A71 (R)
x C103	x(Oh04 x NC34) A71	x(Oh04 x NC34) A71	x A
x(M14 x K155)	x(M14 x K155)	x I205	x W23
x(Oh04 x NC34) A71	x A	x Os420	x Os420
	x W23	x WF9	x I205
	x I205	x W23	x L317
		x Oh26 + Oh28	
		x A	
		x L317	

This group contains a few (R x R) single and (R x S)R three way crosses.

In 1951 the nursery was arranged so that these crosses were planted in alternate blocks with certain inbreds varying in resistance from 1.0 to 3.0. The inbreds were those screened in the 1950 top cross tests, plus those ranging on the borderline of acceptable yield but with other qualities, e.g. stalk rot [Diplodia] resistance and earliness or dark green foliage, that recommended their use. In addition, remnant top-cross seed of high yielding cultures were planted as (R x S) crosses.

The following lines constituted the male parents. Several individual ears of some lines were available.

1.	*(CC15 x J7-6A) A71	M-3**	11.	*(Q63M x CI15) F_5E	M-0-1-2	21.	(51A x J7-6A) M-1
2.	*(Oh04 x NC34) A71	M-1-2	12.	*(A48 x K155)	M-2	22.	(A321 x NC34) M-1
3.	(ND273 x CI15)	M-1	13.	*(Oh33 x NC34)	M-2		M. T. Jenkins'
4.	(Oh33 x CI15)	M-2	14.	*(Q9 x K155)	M-2	23.	recovered WF9
5.	*(W9 x NC34)	M-2	15.	*(Q63M x NC34)	M-2	24.	38-11
6.	(A321 x K175)	M-2	16.	*(A321 x CI15)	M-1	25.	Hy
7.	Switzgable	M-2	17.	(M14 x CI23)	M-1	26.	L317
8.	(M13 x K155)	M-2	18.	(Q83 x K155)	M-2	27.	K64
9.	*(M14 x K155)	M-1-2	19.	(ND273 x NC34)	M-1-2	28.	*K155
10.	*(A321 x K155)	M-0-2	20.	(ND273 x K155)	M-1		

*top-cross seed planted as (R x S) crosses.

**1949 Helminthosporium maydis ratings M-0-1-2-3 where M-0 = most resistant
M-3 = most susceptible

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Table 1. Summary of blight-resistant cultures harvested from 1952 corn disease nursery at State College, Pennsylvania. Each section of the table lists the resistant recoveries from each original resistant parent chosen in 1950.

Original resistant parent -- combinations	Days to silk	H. turcicum / H. maydis**	Ratings 0.5 -	0.5 +	1.0 -	1.0 +	2.0 -	2.0 +	3.0 -	3.0 +	Total
1. C103 x 40B -- all combinations											
	75-80		1	0	10	1	9	0	2	0	23
	81-85		7	3	55	6	27	1	1	0	100
	86-90		11	0	64	15	26	2	--	--	118
	91-95		12	3	51	7	7	--	--	--	80
	96-		4	1	7	--	1	--	--	--	13
		Total	35	7	187	29	70	3	3	0	334
2. C103 -- all remaining combinations											
	75-80		--	--	2	1	15	1	1	--	20
	81-85		1	1	8	1	36	3	--	--	50
	86-90		2	--	31	9	36	7	--	--	85
	91-95		2	1	13	2	17	1	--	--	26
	96-		--	--	2	1	1	--	--	--	4
		Total	5	2	56	14	105	12	1	0	185
3. M14 x K155 -- all remaining combinations											
	75-80		--	--	5	9	33	30	18	3	97
	81-85		1	5	26	34	95	35	5	2	203
	86-90		3	5	18	30	62	10	--	--	128
	91-95		4	8	15	31	28	9	--	--	95
	96-		2	--	5	4	2	--	--	--	13
		Total	10	18	69	107	220	84	23	5	536
4. (Oh04 x Nc34) A71 -- all remaining combinations											
	75-80		3	1	5	5	39	16	8	4	81
	81-85		1	1	17	20	54	39	4	2	138
	86-90		1	0	21	22	36	14	1	--	95
	91-95		1	2	21	3	33	5	--	--	65
	96-		--	1	2	6	5	--	--	--	14
		Total	6	5	66	56	167	74	13	6	393
5. Top crosses -- all remaining combinations											
	75-80		--	2	2	3	21	5	3	--	36
	81-85		1	2	13	19	24	6	1	--	66
	86-90		2	1	17	8	21	2	--	--	51
	91-95		--	--	8	5	9	--	--	--	22
	96-		2	--	6	--	1	1	--	--	10
		Total	5	5	46	35	76	14	4	0	185
Grand total 1 + 2 + 3 + 4 + 5											
	*75-80		4	3	24	18	117	52	32	7	257
	81-85		11	12	119	80	236	84	11	5	558
	86-90		19	6	151	84	181	35	1	--	477
	91-95		19	14	108	48	94	15	--	--	298
	96-		8	2	22	11	10	2	--	--	55
		Total	61	37	424	241	638	188	44	12	1645

*Since corn took 15 to 17 days to emerge, owing to cold wet weather, about 8 to 10 days should be subtracted for normal silking dates.

**H. maydis was rated (-) = slight, and (+) = objectionable amount of infection.

Table 2. Summary of cultures in Table 1 related to M. T. Jenkins' recovered lines by individual line.

Line	Days to silk	H. turcicum / H. maydis	Ratings 0.5 -	0.5 +	1.0 -	1.0 +	2.0 -	2.0 +	Total
1. WF 9 (recovered)									
	75-80		-	-	-	-	3	2	5
	81-85		-	2	1	5	3	6	17
	86-90		-	-	3	3	4	3	13
	91-95		-	-	-	-	1	1	2
	96-		1	-	-	2	1	-	4
		Total	1	2	4	10	12	12	41
2. 38-11 (recovered)									
	75-80		-	-	-	-	-	-	0
	81-85		2	4	2	5	3	2	18
	86-90		-	3	2	5	5	2	17
	91-95		-	4	0	5	6	1	16
	96-		-	-	-	-	1	-	1
		Total	2	11	4	15	15	5	52
3. Hy (recovered)									
	75-80		-	-	-	1	-	-	1
	81-85		-	2	1	3	8	3	17
	86-90		4	-	0	7	10	3	33
	91-95		-	2	11	1	8	2	24
	96-		-	-	2	-	1	-	3
		Total	4	4	23	12	27	28	78
4. L317 (recovered)									
	75-80		-	-	-	-	-	2	2
	81-85		-	-	5	2	5	2	14
	86-90		3	1	6	1	16	1	28
	91-95		3	-	3	3	11	1	21
	96-		-	1	1	1	-	-	3
		Total	6	2	15	7	32	6	68
5. K64 (recovered)									
	75-80		-	-	-	-	-	-	0
	81-85		2	-	0	1	5	3	11
	86-90		3	-	6	1	6	0	16
	91-95		2	-	3	0	3	-	8
	96-		1	-	-	-	-	-	1
		Total	8	0	9	2	14	3	36

The 1951 season was very dry. As a result fewer crosses were made with the later lines. M14 x K155 was most often used as a male parent because of its earliness. We did not obtain a solitary cross with K155 itself, but a late rain permitted a few crosses with Jenkins' recovered lines. In all, 906 random crosses were made of which 215 were discarded, chiefly because of smut [Ustilago maydis] and stalk-rot. The singles composed of Os420 and W23 were greatly reduced by stalk-rot.

Late August and September moisture allowed a build up of H. turcicum but H. maydis did not develop sufficiently to permit ratings.

The 691 remaining crosses were divided into two groups, those for which the female parent rated 3.0 or less, and those with higher ratings. The 425 ears from plants rating 3.0 or less were planted in 10-foot single rows in 1952 on May 7 and 8.

It rained 24 of the 31 days in May, making a wet cold spring. Corn took 15 to 17 days to appear above ground and stands were severely reduced. I believe the nursery of hybrid material was the thinnest I have ever had. All crosses were selfed.

This material was given our usual comprehensive treatment for root rots, smut, blight, and stalk rot (1, 2). The season was dry but not as lacking in moisture as 1951. Both H. turcicum and H. maydis developed well, although their appearance was somewhat delayed. Frost did not occur until October 4. Stalk rot was not severe but kernel smut was severe.

Except for early material, harvesting was limited to plants with an H. turcicum rating of 2.0 or less, and only ears with good kernel characteristics were taken. Ears were dried at 100° to 110° F, and shelled.

The results are tabulated in Table 1 and are presented as individual contributions of each resistant line or cross.

In southeastern Pennsylvania and in New Jersey and Delaware, there is growing concern about hybrids susceptible to Helminthosporium maydis. Since the hybrids chiefly grown are of U.S. 13 maturity or later, we are constantly on the alert for late material resistant to H. maydis. Ohio 43, Ohio 45, and Ill. R4 have the required resistance but are susceptible to H. turcicum. A back-crossing program involving Jenkins' recovered lines might be used. In a search for H. maydis-resistant cultures which could be useful in such a program, the material in Table 1 was reorganized in Table 2, with respect to cultures already crossed with Jenkins' recovered lines. It would appear that material is available, although desirable WF9 and 38-11 selections are in short supply.

Note -- Remnant seed of these crosses is available to anyone who wishes to inoculate and make his own selections.

Summary

1. The data presented show that inbred lines of corn of intermediate resistance or complete susceptibility may profitably be employed in a leaf blight-resistance program, provided that there are available a few lines of a higher degree of resistance, with which crosses may be made.

2. The data also indicate that crosses of the type (R x S)R^1 or (R x S)R produce hybrids of a desirable order of resistance in superior numbers to (R x S) crosses selfed.

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PENNSYLVANIA STATE COLLEGE, STATE COLLEGE

THE CEREAL RUSTS AND OTHER DISEASES OF SMALL GRAINS IN MISSISSIPPI[1]

Thomas E. Summers[2] and Donald H. Bowman[3]

Several developments make it desirable that the present known status of the diseases affecting small grains in Mississippi be reported. In 1952 for the first time in recent years the stem rusts of oats and wheat approached in importance the leaf rusts. Stem rust was also observed on barley and rye. Controlled experiments have established the presence of an aphid-transmissible virus of oats in this State (to be reported in detail elsewhere later). This disease destroyed an estimated 5 to 10 percent of the oat plants of the 1950-51 crop. The importance of the downy mildew disease of oats in the Delta area of Mississippi has been reported (PDR 36: 347. 1952). Septoria spp. caused severe damage to certain varieties of wheat in South Mississippi. Other diseases, including 11 found for the first time in Mississippi, are reported.

Diseases of Oats

The diseases reported here are those observed and identified over a period of less than two and a half years. There are probably other diseases which affect oats in Mississippi that did not occur during this period, were overlooked, or were not recognized. In several other instances diagnosis was confirmed by isolation of fungi, the pathogenicity of which, however, was not proven and which are not reported here.

Stem Rust (Puccinia graminis avenae): In 1950 and again in 1952 stem rust of oats appeared early enough in the season to cause some concern though subsequent losses were slight to negligible. All commercially grown varieties were attacked both in field plantings and in the nursery at Stoneville. Only certain selections with Clinton-Santa Fe in their parentage were resistant in this nursery. The early maturing Delair variety showed the least amount of infection of any of the commonly grown varieties. Severity of infection in commercial plantings ranged from none in some fields to 20 percent in other fields. Race 8 was the most prevalent race in the State; race 2 was identified at St. Paul, Minnesota from specimens collected at Stoneville.

Leaf Rust (Puccinia coronata avenae): Leaf rust caused some damage in 1950, very little in 1951, and practically no damage in 1952. Delair was the most severely infected of the commercially grown varieties. The Victoria derivatives were damaged less than the red rust-proof varieties.

Red Leaf (Virus): This disease was prevalent and quite destructive in 1950 and was the most destructive oat disease in Mississippi in 1951. It was estimated that in 1951 between 5 and 10 percent of the oat plants in the State were destroyed by the virus. Very little of this disease occurred in 1952 except in localized areas and fields. It was found in a 100-acre field of oats grown under irrigation at Brookhaven on October 17, 1952.

The writers prefer to call the disease, as found in Mississippi, "Red Leaf" of oats until it can be definitely determined whether this virus is the same as that reported by Oswald and Houston (PDR 35: 471. 1951) and referred to as "Yellow Dwarf" of barley. The virus was readily transmitted from oats to oats and from oats to barley by the greenbug, Toxoptera graminum Rondani, and the English grain aphid, Macrosiphum granarium (Kirby), in experiments conducted by the senior author. An attempt to transmit the virus from oats to Hardired wheat was unsuccessful. This evidence is insufficient to confirm the virus as being the same as that reported by Oswald and Houston.

Macrosiphum granarium was found to be a vector of a recently discovered (first report as far as the writers know) virus of Holcus halepensis (Johnson grass). In controlled experiments in the greenhouse, this virus mildly affected oats to which the virus had been transmitted by this insect. The virus affecting Johnson grass was widespread over the entire State

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during the summer and fall of 1950 and spring of 1951. In 1952, it was observed only in South Mississippi and at one location in the Delta area. Owing to extreme drought conditions in the fall of 1951 and in 1952 very few oat fields had become established (except a few grown under irrigation) before the latter part of October. By this time most of the native Johnson grass had been killed by frost.

The English grain aphid's habit of migrating from small grains to summer grasses in early summer, and back to small grains in the fall, suggests that this species may be of considerable importance in the perpetuation of the red-leaf virus. Its distribution in the field is also more scattered than that of Toxoptera graminum which has a tendency toward gregariousness.

Plants growing in certain fields and infected by the red-leaf virus at an early stage always possess roots that are very badly decayed. These plants are killed as seedlings or in the rosette stage; however, plants infected while growing in sterilized soil in the greenhouse usually are not killed or are killed rather slowly. Field plants naturally infected at a later stage of development, and after the temperature of the soil has risen, usually escape death until a premature ripening of the stunted plants has taken place. It is possible that some root-inhabiting fungus or fungi may aid in bringing about the ultimate death of some of the virus-infected plants under conditions of low soil temperatures, although unable to affect virus-free plants seriously.

On several occasions in individual reddened leaves that had been fed upon by the fall armyworm, Laphygma frugiperda (J. E. Smith), a fungus could be observed invading the cells surrounding the feeding lesions with an accompanying production of red pigment in the conducting tissue. The discoloration has been observed to spread to other leaves of the plant.

Downy Mildew (Sclerospora macrospora): This disease, according to Dr. Andrew D. Suttle of the Mississippi Agricultural Experiment Station, has been causing damage to oats in the Delta area of Mississippi since 1936. It was the most important disease of oats in the State in 1952. The disease has been reported in somewhat greater detail earlier, though the complete life history of the fungus is not yet understood. The seedling stage of this disease is very difficult to diagnose and the death of young plants caused by Sclerospora macrospora may have been attributed to other causes in the past. Another loss from this disease, other than death of seedlings and loss of grain production by infected mature plants, is the considerable problem of the storage of harvested oats, which contain a large amount of the green tissue of infected plants.

This disease may assume even greater importance in the Delta area of Mississippi, with a probable increase in wheat, rice, and possibly barley acreage in the near future.

Holcus halepensis, one of the most widely distributed grasses in Mississippi, was infected by a Sclerospora sp. at State College and in the Delta area in the fall of 1952. Many diseased plants were found along the edge of fields in which oats had been observed during the previous spring to be infected by S. macrospora. The symptoms of the downy-mildew disease thus far observed on this grass have consisted of a very slight thickening and barely perceptible roughing of the infected leaves. No extensive distortion of the leaves or malformation of the inflorescence, or both, such as is produced by S. macrospora on oats, has been observed. The infected leaves are killed somewhat prematurely and infected plants seem to be differentially killed by the first frost of the season.

Measurements of oospores of the Johnson grass pathogen fell within the range published for S. macrospora; this is considered insufficient evidence on which to base positive identification, and further work is under way to establish its identity. This is the first report of this disease on Holcus halepensis from Mississippi and the first known to the authors of a downy-mildew fungus attacking this host. The significance of abundant occurrence of the disease on this host, if the fungus proves to be parasitic on any of the small grains grown in the Delta area of Mississippi, Arkansas, and Louisiana, is obvious.

Helminthosporium Leaf Blotch (Pyrenophora avenae) (Helminthosporium avenae): At the present time this disease is considered to be of major importance because of its detrimental effect on foliage quality during the period when oats are normally grazed as a fall and winter pasture crop in Mississippi. The disease was prevalent and quite severe in local areas over the southern half of the State in 1951 and 1952.

The fungus may be of greater importance as a cause of seedling blight than is generally realized. Its relationship to plants infected with the red-leaf virus should be investigated.

Isolations from the decaying roots and crown of plants infected with the virus have on several occasions yielded Helminthosporium avenae. The fungus is usually found sporulating abundantly on the leaves of plants killed by the red-leaf virus though the two diseases are not associated in all cases.

Halo Blight (Pseudomonas coronafaciens): Halo blight appeared in some commercial plantings in the Delta area and was prevalent in the oat nursery at Stoneville during March in 1950 and 1952. Differences in varietal reactions were apparent, but the disease disappeared with the arrival of warmer weather and apparently caused little damage.

Mycosphaerella Leaf Disease (Mycosphaerella holci): This fungus was consistently isolated from large tan to brown lesions on the leaves of a Woodward winter-oat selection grown in the nurseries at State College, Oakley, and Stoneville, Mississippi, and at Stuttgart, Arkansas.

Smuts (Ustilago avenae and U. kolleri): Smut was observed in only five commercial fields in 1952 and infected plants did not exceed 2 percent in any field observed. Several fields near Brookhaven were reported to have contained more than 10 percent infected plants. It was present in the nurseries at Stoneville and Holly Springs in 1951 and 1952.

Speckled Blotch (Leptosphaeria avenaria) (Septoria avenae): The leaf blotch phase, but not the black stem phase, of this disease was observed at Stoneville in May of 1950 and 1951. The fungus produced pycnidia and pycnospores, and perithecia with asci containing ascospores in corn meal agar.

Typhula Scald (Typhula sp.): Following a period of exceptionally cold wet weather and an ice storm in February 1951, patches of dead foliage were observed in several oat fields in South Central Mississippi. Small sclerotia were found on the leaves and were formed in culture. Small, white, sterile sporophores also were formed in culture. No attempt was made to identify the species as conditions favorable for the development of the fungus are reported to occur only seldom in this region.

Victoria Blight (Helminthosporium victoriae): Isolates from Southland oats collected in late May of 1950 which at the time of collection were assumed to be affected by Helminthosporium victoriae failed to produce symptoms of Victoria blight on Victorgrain or Victoria oats. The fungus was tentatively identified as H. sativum and was probably the same as the organism designated "culm rot organism" by Earhart (PDR 35: 444. 1951). H. victoriae has not been isolated from oat plants in Mississippi within the last two years by the authors. Varieties with Victoria in their parentage account for about 35 percent of the oat acreage planted for grain.

Anthracnose (Colletotrichum graminicola): This disease was fairly prevalent in fields of low fertility in the hill section of Mississippi in 1950. None was observed in 1951 and it was found only in three fields in 1952.

Phyllachora Leaf Spot (Phyllachora graminis): The pathogenicity of the fungus was not definitely established and since it was isolated only from lesions on mature plant leaves, it is probably associated with senile leaf tissue.

Diseases of Wheat

Wheat has been a minor crop during recent years; however, several fairly large commercial plantings were made in the fall of 1951 and another considerable increase in acreage was seeded in 1952. Diseases were relatively light in 1952 and yields for the 1951-52 crop were exceptionally good.

Stem Rust (Puccinia graminis tritici): Stem rust appeared in the nursery at Poplarville before April 1, 1952, and became quite prevalent in the nursery at Stoneville by May 9. It was found during April at State College, but it did not develop to any great extent until after the middle of May, thereby causing little damage. Chancellor, the variety most widely grown in Mississippi, was attacked both in commercial plantings and in the nurseries in the State.

Atlas 66, which has been recommended for this State, had only a trace in most plantings and none in a special observation nursery in which Hardired had a severity reading of 70 percent.

Race 15B was the most prevalent race present in 1952, race 38 was next in abundance, and race 17 occurred on one collection sent to St. Paul, Minnesota, for identification. Races 15B and 38 attacked both Balbo rye and certain barleys at State College.

Leaf Rust (Puccinia rubigo-vera tritici): Prior to 1952, leaf rust had been the most prevalent and destructive disease of wheat. This year, though neither caused appreciable losses in yield, stem rust probably was more widespread in occurrence and equally as important. Chancellor had more leaf rust than Atlas 66, the only two varieties observed in commercial plantings.

Races 5, 9, 15, 19, 21, 50, 58, 91, 105, and 126 were reported from collections sent to Mr. C. O. Johnston in 1950 and 1951. Information on the races present in 1952 has not been received.

Powdery Mildew (Erysiphe graminis tritici): Chancellor and Atlas 66 were attacked about equally by powdery mildew in 1951 and 1952 though little loss was sustained commercially. In the disease observation nursery at State College severe lodging was caused on susceptible varieties.

Septoria Blotch (Septoria nodorum): A fungus which has tentatively been identified as Septoria nodorum attacked the leaves, culms, and glumes of certain wheats grown at Poplarville, Stoneville, State College, and Holly Springs. Severity of the infection on the leaves makes the name "glume blotch" inappropriate under Mississippi conditions. Severe damage was sustained by certain varieties at Poplarville, some selections being practically destroyed prior to heading. Plants in the rosette stage as well as more mature plants were attacked.

Many specimens of diseased plants collected in 1952 were examined by the senior author and in all cases S. nodorum-like pycnidia and pycnospores were found. Sharp differences in varietal reaction were observed in the field and from greenhouse inoculations. In view of the potential destructiveness of the disease it would seem desirable that the taxonomic vagueness concerning the fungus in the South be clarified. If S. tritici was involved in 1952 it played a minor role on the material observed.

Take-all (Ophiobolus graminis): Take-all was found by the junior author in a nursery at Stoneville in 1949. No wheat has been grown on the land since that year and no other outbreaks have been observed. Identification of the fungus was made by Dr. A. G. Johnson. This is the first report of occurrence of this disease in Mississippi.

Loose Smut (Ustilago tritici): With the exception of the occurrence at Holly Springs in 1951 and 1952 loose smut has not been observed in significant amounts in the nurseries. Several fields in the Delta area contained as many as 10 percent infected plants in 1952.

Bacterial Stripe (Xanthomonas translucens): This disease appeared in the Stoneville nurseries on Trumbull-Frondoso selections and at State College on wheat introductions from Mexico.

Diseases of Barley

No commercial plantings of barley have been observed in Mississippi and the diseases recorded here occurred on plants in nurseries at State College or Poplarville.

Stem Rust (Puccinia graminis): The only definite information available as to the varieties of stem rust attacking barley in Mississippi consists of the identification by Dr. E. C. Stakman of races 38 and 15B of P. graminis tritici, which occurred on barley at State College in 1952. In a planting of spring-type barleys at State College, Montcalm, Oderbrucher, and Manchuria were completely susceptible with severity readings of 50, 35, and 15 percent respectively. The reaction of Moore was intermediate with a severity reading of 1 percent.

Leaf Rust (Puccinia hordei): Selections grown in the breeding nursery ranged from those which were free from rust to those which had a severity reading of 80 percent. It is not con-

sidered that leaf rust will become a limiting factor in barley production.

Spot Blotch (Helminthosporium sativum): At the present time this is considered to be the most important disease affecting barley. Some varieties reported resistant to the disease at other locations have been susceptible in Mississippi. Whether this is a result of physiological strains of H. sativum or a breakdown of resistance under Mississippi conditions has not been determined.

Powdery Mildew (Erysiphe graminis hordei): Under conditions favorable for its development powdery mildew may become extremely severe on susceptible varieties of barley. Severe lodging and even death of the plants prior to maturity have been observed to result from this disease. In 1952 only two entries in the uniform barley mildew nursery were infected, indicating that all the known physiologic races were not present in Mississippi. Susceptible varieties were heavily infected on January 11, 1951, at the Poplarville station.

Rhynchosporium Scald (Rhynchosporium secalis): Rhynchosporium secalis attacked certain selections in the State College nursery and was very destructive to susceptible varieties. The disease was observed as early as January 11 at Poplarville in 1951.

Bacterial Blight (Xanthomonas translucens): Rather severe damage was caused to certain varieties of barley grown in the State College nursery in 1952.

Net Blotch (Pyrenophora teres) (Helminthosporium teres): Though no characteristic leaf lesions of this disease have been observed in Mississippi, several isolates of H. teres were recovered from leaf spots. It is not known whether the disease occurred only occasionally in the last two years, or whether typical lesions did not develop under the prevailing conditions.

Loose Smut (Ustilago nuda): Smut occurred in insignificant amounts in 1951 and 1952.

Barley Stripe (Helminthosporium gramineum): This disease was observed on one variety in the spring of 1951.

Diseases of Rye

Rye has not been observed other than in the nurseries at State College, Newton, and Poplarville.

Stem Rust (Puccinia graminis): Both Puccinia graminis secalis and physiologic races 15B and 38 of P. graminis tritici occurred on rye in 1952 at State College.

Leaf Rust (Puccinia rubigo-vera secalis): The susceptible variety Balbo was severely affected by leaf rust in December 1951 at the Newton station and was also badly damaged during the previous spring at the Poplarville station.

Anthracnose (Colletotrichum graminicola): In 1951 Colletotrichum graminicola was found fruiting and causing local spots on the leaves of rye plants in the State College nursery, but apparently little damage resulted. Although the fungus did not fruit on the leaves, severe damage to the breeding nursery was attributed to this disease in 1952. The initial symptoms this year were rather vague. In May, tufts of mycelium were observed on the upper surface of rye leaves, followed by a withering and death of the leaves. Isolations from the leaves yielded only Helminthosporium tetramera, H. triseptatum, and a Heterosporium sp. Later black acervuli with black setae formed on the nodes and lower leaf sheaths of the infected plants. Conidia shape and size were identical with the specifications for Colletotrichum graminicola.

The damage to rye in this nursery from anthracnose was the most severe the writers have observed. In 1950 a small field of oats in western Alabama was practically destroyed by the disease.

Since no clear varietal differences to the disease have been noted, it probably should be considered as a major disease of rye.

Rhynchosporium Scald (Rhynchosporium secalis): A trace of this disease appeared in the nursery at State College in 1951.

DIVISION OF CEREAL CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING, U. S. DEPARTMENT OF AGRICULTURE; DELTA BRANCH EXPERIMENT STATION, STONEVILLE, MISSISSIPPI

TAKE-ALL DISEASE OF WHEAT IN ILLINOIS

Aaron G. Johnson and Benjamin Koehler

In 1919, a destructive disease of wheat was discovered in Madison County, Illinois. This disease was tentatively called "take-all" (2, 3), but subsequent studies showed it to be distinctly different; and it was designated "rosette" disease (4, 8). The take-all fungus (Ophiobolus graminis) did not occur on the diseased plants studied at that time. Later, this rosette disease was found to be one of the mosaic diseases of wheat (6, 7) caused by a virus.

From time to time over a number of years, diseased plants from spots in fields of wheat and rye in Illinois have been examined by the junior writer. These have shown characteristic symptoms of take-all, namely: premature dying of the plants, blackened crowns, and black, mycelial plates inside the basal sheaths of diseased culms. No perithecia of Ophiobolus graminis were found (5). Presumably, because of the apparent absence of the perithecial stage of the fungus, Boewe (1) reported that take-all was not known to occur in Illinois. Sprague (9), however, reported the disease as occurring in Illinois, but gave no evidence of the perithecial stage having been found there.

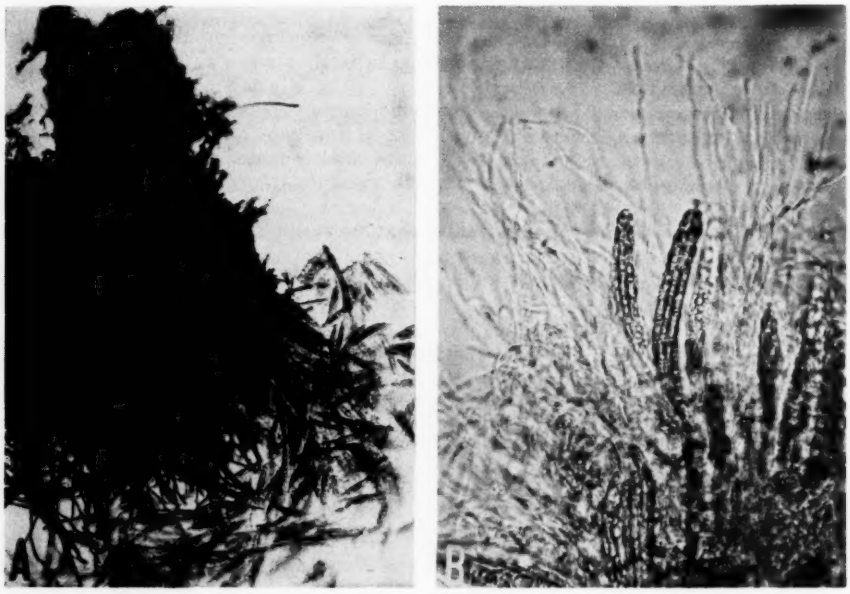

FIGURE 1. Perithecium and asci of Ophiobolus graminis from Royal wheat from near Hutsonville, Illinois, collected June 30, 1952. A, Perithecium and asci, (approx. X 94); B, Asci and paraphyses, (approx. X 375).

In late June, 1952, the senior writer, while visiting friends near Hutsonville, Illinois, was asked about diseased spots in fields of Royal wheat. Although the wheat had just been harvested, the spots could readily be located by the abundant growth of weeds in them. Stubble specimens were collected from diseased spots in two fields. Subsequent examination with a hand lens showed numerous black fruiting bodies at the bases of some of the specimens, with perithecial necks protruding through the basal sheaths. Some of these fruiting bodies were examined microscopically and were found to be mature perithecia of the take-all fungus, Ophiobolus graminis Sacc. (Gaeumannomyces graminis (Sacc.) Arx & Olivier). One of these perithecia and characteristic asci and ascospores are shown in Figure 1.

Specimens with mature perithecia have been deposited in the herbarium of the Illinois State Natural History Survey, Urbana, Illinois, and in the Mycological Collections of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Maryland.

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DIVISION OF CEREAL CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, IN COOPERATION WITH THE ILLINOIS AGRICULTURAL EXPERIMENT STATION.

SPOT BLOTCH OF BROME GRASSES, TALL FESCUE GRASS, AND BARLEY

E. S. Luttrell

In two preceding reports (2, 3) a blotch attributed to Helminthosporium sativum Pam., King, & Bakke was described on tall fescue grass (Festuca arundinacea Shreb.), smooth brome grass (Bromus inermis Leyss.), and rescue grass (B. cathartícus Vahl.). Since these reports apparently constitute the first record of H. sativum as a cause of leaf diseases of these grasses, a comparison was made of the morphology and pathogenicity of the fungus from these three hosts with H. sativum from barley, the type host of the species.

Helminthosporium sativum was previously reported as causing a root rot of smooth brome grass in the Northwest and in Virginia (6) and of rescue grass in North Dakota (5). A leaf spot of rescue grass attributed merely to Helminthosporium sp. was recorded from Florida and Georgia (6); and in view of the common occurrence of spot blotch in Georgia (3), it seems probable that this undetermined species was H. sativum. Spot blotch of meadow fescue (Festuca elatior L.), a grass very closely related to tall fescue, was found in Iowa (4) in 1910.

As is apparent from the descriptions given in preceding reports (2, 3) symptoms of spot blotch on smooth brome grass and rescue grass are similar to those of spot blotch on barley (1). Symptoms on tall fescue grass differ in that usually there are only a few spots per leaf and the spots remain rather small. Dimensions and septation of conidia in Georgia material were similar and were within the range that might be expected in so variable a species as Helminthosporium sativum (Table 1). Conidia from mature leaves of all hosts naturally infected in the field were of the type described as characteristic of this species by Drechsler (1). They were fusoid, straight or slightly curved, and ultimately thick-walled and dark-olivaceous. In some collections in which they were not fully mature the conidia were relatively thin-walled and pale olivaceous or brown, although they had attained their maximum size.

Table 1. A comparison of conidia of Helminthosporium sativum from barley, smooth brome grass, rescue grass, and tall fescue grass.

Host	Length	Mean length[a]	Width	Mean width[a]	Septa	Mean septa[a]
	microns	microns	microns	microns	number	number
Barley	44.8- 89.6	69.3	14.8-22.4	18.4	3- 8	6.5
	72.8-128.8	103.9	16.5-21.8	18.3	6-11	8.6
Smooth brome grass	46.2-117.6	95.4	15.4-21.0	18.6	3-13	9.0
	81.2-120.4	97.7	16.8-19.6	18.6	6-13	8.6
Rescue grass	44.8-114.8	85.6	16.8-22.4	18.6	5-10	8.1
	42.0-117.6	82.4	14.0-22.4	19.2	4-12	7.7
Tall fescue grass	67.2-114.8	88.9	16.8-22.4	20.0	5-10	8.2

[a] Mean measurements of 25 conidia.

The pathogenicity of one isolate from each of the four hosts was tested on barley, smooth brome, rescue grass, and tall fescue. Inoculations were made on nearly mature plants grown in six-inch pots in the greenhouse. Three pots of each host were inoculated with each isolate. Inoculum consisted of a 2% malt agar plate culture macerated in a Waring Blendor with 100 cc. of water. The suspension of mycelial fragments and conidia was sprayed onto the plants, which were then placed in an inoculation chamber for 48 hours. Counts of the number of leaves infected and estimates of the percentage of total leaf area infected were made at the end of two weeks. The results of these inoculations are given in Table 2.

Some variation in the results might be expected since the inoculations with each isolate

Table 2. Results of cross inoculations with Helminthosporium sativum on barley, smooth brome grass, rescue grass, and tall fescue grass.

Inoculum -- source of isolate	Host inoculated: Colonial barley		Smooth brome		Rescue grass		Tall fescue	
	Leaves infected	Damage	Leaves infected	Damage	Leaves infected	Damage	Leaves infected	Damage
	percent	percent	percent	percent	percent	percent	percent	percent
Barley	82	63	48	11	26	T	2	0
Smooth brome	63	43	57	22	70	37	17	T
Rescue grass	58	17	19	1	47	5	0	0
Tall fescue	80	33	77	17	82	25	70	1

were made separately and on different dates. Some of the variation, however, may be attributable to differences among the isolates. The isolate from rescue grass, for example, appeared to be less virulent on barley, smooth brome, and rescue grass than the isolates from other hosts; and this isolate produced no infection on tall fescue. However, little infection resulted with any isolate on tall fescue. Although there was a suggestion of differences in degree of virulence among these isolates, there was little indication of host specificity. In agreement with field observations (2, 3), the results of these inoculations indicate that the susceptibility of smooth brome and rescue grass to leaf infection with Helminthosporium sativum approaches that of barley, while tall fescue grass is highly resistant.

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GEORGIA EXPERIMENT STATION, EXPERIMENT, GEORGIA

SEED TREATMENT FOR CONTROL OF HEAD SMUT IN MOUNTAIN BROME IN 1952

Jack P. Meiners

Seed treatment tests to control head smut (Ustilago bullata Berk.) on mountain brome were conducted at Pullman, Washington, in 1952. Seed of the variety Bromar was inoculated with a new, virulent strain which is capable of producing high percentages of smut on this variety[1]. The seed treatments were applied as slurries, liquids, and dusts at dosages ranging from 1/2 to 6 ounces per bushel (Table 1). Concentration of slurry and amount of slurry applied to the seed were also varied (Table 1).

Table 1. Effect of seed treatment with different fungicides, applied in various forms and at various dosages, on the incidence of head smut in Bromar mountain brome.

	Treatment					
No.	Material	Dosage oz./bu.	Methods of application	Slurry Conc. lbs./gal.*	Bu. seed/ gal. slurry	Percent smut
1	Untreated	---	---	---	---	97.0
2	Ceresan M	0.5	Slurry	1	32	3.6
3		1	"	2	32	2.9
4		0.5	"	0.5	16	7.2
5		1	"	1	16	.8
6		1.5	"	1.5	16	1.8
7		2	"	2	16	.5
8		0.5	Dust	---	---	1.6
9		1	"	---	---	1.0
10		1.5	"	---	---	.7
11		2	"	---	---	0.0
12	Arasan SF	1	Slurry	2	32	52.6
13		2	"	4	32	44.2
14		1	"	1	16	46.6
15		2	"	2	16	49.6
16		4	"	4	16	37.0
17	Arasan	1	Dust	---	---	44.2
18		2	"	---	---	29.3
19		4	"	---	---	15.4
20		6	"	---	---	13.8
21	Panogen	0.75	Slurry	0.75	16	1.6
22		1	"	1	16	0.0
23		1.5	"	1.5	16	.7
24		0.75	Liquid	---	---	.7
25		1	"	---	---	.1
26		1.5	"	---	---	.8

[1] Meiners, Jack P. 1952. A new race of head smut on Bromar variety of mountain brome. Plant Dis. Reptr. 36: 166.

Table 1 continued.

No.	Material	Treatment: Dosage oz./bu.	Methods of application	Slurry Conc. lbs./gal.*	Bu. seed/ gal. slurry	Percent smut
27	Agrox	0.5	Slurry	0.5	16	85.2
28		1	"	1	16	60.7
29		2	"	2	16	41.2
30		0.5	Dust	---	---	69.9
31		1	"	---	---	40.1
32		1.5	"	---	---	5.2
33	Mergamma	4	Dust	---	---	11.2
34		6	"	---	---	1.1
35	Vancide 51	2	Slurry	2	16	69.1
36		3	"	3	16	28.7
37		4	Liquid	---	---	12.4
38		6	"	---	---	3.5

* pounds of material per gallon of water

For each treatment 1/2 pound of seed was placed in a two-liter flask, the fungicide was added and the flask was agitated until the seed was well coated. The seed was then placed in paper bags, covered, and allowed to stand for several days after which it was planted in the greenhouse. Each treatment was replicated four times. After one month the seedlings were set out-of-doors to accomplish vernalization and then transplanted to the nursery in April. Percentages of smut, based on head counts, were made in August. The results are presented in Table 1.

Of the seven fungicides tested, only two gave adequate control of head smut without reducing stands. These were the volatile mercury compounds, Ceresan M and Panogen. There were no significant differences in effectiveness of these two materials, regardless of dosage or methods of application used. At 6 ounces per bushel, Mergamma and Vancide 51 also controlled head smut but caused some reduction in stand. They were proportionately less effective at lower dosages, and Vancide 51 appeared to be more effective in liquid form than as a slurry.

Those materials which did not provide adequate control of head smut at any dosage were Arasan, Arasan SF, and Agrox. In previous tests Arasan has given good control of head smut of grasses and has been recommended for this purpose. However, in view of the inadequate control obtained with this material in these present tests, it can no longer be recommended for control of head smut on mountain brome.

WASHINGTON AGRICULTURAL EXPERIMENT STATIONS IN COOPERATION WITH THE BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING, DIVISION OF FORAGE CROPS AND DISEASES AND THE SOIL CONSERVATION SERVICE, DIVISION OF NURSERIES, UNITED STATES DEPARTMENT OF AGRICULTURE

SOYBEAN DISEASES IN MISSISSIPPI IN 1951-52[1]

Howard W. Johnson and R. A. Kilpatrick

Ling[2] lists the causal organisms of approximately 135 parasitic diseases reported to attack soybeans in various parts of the world. Presley[3] lists 12 of these as occurring in Mississippi. Observations by the authors in 1951 and 1952 revealed several diseases not listed in the Mississippi host index[3], despite the fact that both seasons were dry and unfavorable for the development of foliar diseases.

Bacterial foliar diseases were the most prevalent of all soybean diseases each year. Bacterial pustule caused by Xanthomonas phaseoli was present in virtually every field examined. Bacterial blight (Pseudomonas glycinea) was found in some fields, although this disease was less severe than bacterial pustule. Wildfire (Pseudomonas tabaci) was found in 1951, but was not observed in 1952.

Downy mildew caused by Peronospora manshurica was prevalent during both years. In 1951, no incrusted seeds were found, while in 1952, several strains of soybeans, which had shown very little leaf infection, had incrusted seeds. Two types of leaf lesions were found on some strains; one characterized by small, pin-point infections, the other by lesions varying from 1/2 to 1 cm. in diameter. It appears that two races of P. manshurica may occur in this area.

A leaf spot caused by Phyllosticta sp. was prevalent during the early part of the 1951 season but was inconspicuous in 1952. Target spot (Corynespora cassiicola) was found in some fields in 1951, but it also was scarce in 1952. This disease appears late in the growing season but may cause premature defoliation if prevalent. Varietal and strain differences in susceptibility are evident, and breeding for resistance to target spot should be possible. A leaf spot caused by Alternaria sp. was found in both years, but never in amounts sufficient to cause appreciable damage. Frogeye leaf spot caused by Cercospora sojina was present in a few fields in 1951 and was found occasionally in 1952. It was not a serious disease in either year.

Late in the growing season of both years, a leaf, stem, and pod spotting was noted and a Cercospora sp. was isolated frequently from the lesions. The leaf spots varied from pinpoint size to approximately 5 mm. in diameter and coalesced to cover large areas in some instances. They were reddish-brown with grey centers and frequently were abundant enough to give the entire leaf a dull, rusty appearance. The disease caused premature defoliation of some varieties during both years. The spots on the stems were oval to elongate, ranging from 2 to 30 mm. in length and from 1 to 5 mm. in width. They frequently coalesced to form large discolored areas that were reddish-brown in early stages but later changed to different shades of gray or black (Figure 1). The spots on pods were discrete and varied from pinpoint size to 2 mm. in diameter. They appeared somewhat similar to those caused by Corynespora cassiicola. This spotting seems to be correlated with maturity of the host plant.

Other diseases found during both years were: Pod and stem blight caused by Diaporthe phaseolorum var. sojae, charcoal rot caused by Sclerotium bataticola, southern blight caused by Sclerotium rolfsii, purple seed stain caused by Cercospora kikuchii, and anthracnose caused by Colletotrichum spp. Root diseases were observed less frequently than diseases of aerial parts of the plant, except for the widespread occurrence of charcoal rot on the roots of plants nearing maturity and in spots subject to severe drought.

Soybean mosaic (Soja virus 1) was observed each year, and yellow bean mosaic (Phaseolus virus 2) was observed for the first time in 1952. The incidence of each was low and at present virus diseases do not appear to be a factor in soybean production in Mississippi.

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[1]Investigations of soybean diseases are conducted at the Delta Branch Experiment Station, Stoneville, Mississippi, through a cooperative agreement between the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, and the Mississippi Agricultural Experiment Station, Journal article No. 30i, Mississippi Agricultural Experiment Station.

[2]Ling, Lee. 1951. Bibliography of soybean diseases. Plant Dis. Reptr. Supl. 204: 110-173.

[3]Presley, J. T. 1947. A host index of Mississippi plant diseases. Plant Dis. Reptr. Supl. 169: 117-118.

FIGURE 1. Spotting of soybean stems caused by Cercospora sp. This stage develops late in the season about, or after, maturity of the soybean plants.

The following soybean diseases, which are not listed in the host index of Mississippi plant diseases, were observed in 1951 or 1952: Phyllosticta leaf spot, target spot, Alternaria leaf spot, anthracnose, purple seed stain, and yellow bean mosaic.

COOPERATIVE INVESTIGATIONS BY THE DIVISION OF FORAGE CROPS AND DISEASES, U. S. BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AND THE MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

CRICONEMOIDES SP., A RING NEMATODE ASSOCIATED WITH PEANUT "YELLOWS"

J. H. Machmer

Severe chlorosis of peanut in central east Georgia was noted in September, 1950. The chlorosis in some fields was so pronounced as to give, from a distance, the suggestion of a yellow-flowering crotalaria in bloom, unlike the rusty, yellowish and mottled appearance associated with root-knot nematode injury.

Peanut root samples, with surrounding soil, were taken to the laboratory and nematodes were collected by the Baermann technique as described by Christie and Perry 1951 (Proc. Helminthol. Soc. Washington 18: 106-108). Pratylenchus, Criconemoides, and Helicotylenchus species were found in and on roots, great numbers of Criconemoides being obtained.

In late August, 1951, other fields were found with similar symptoms of an evenly bright chlorosis. Part of a field in Laurens County, shown in the Table as "terrace" was selected for study. The "yellow" part of this terrace was about 35 peanut rows wide and 150 yards long. It had a history of a two-year rotation of corn and blue lupine, since peanuts had been last grown. The "green" part of the terrace was about 90 peanut rows wide, and had a fair stand of peanuts. This crop had been grown on this field for several successive years. The soil is a sandy loam.

Table 1. Number of Criconemoides associated with a chlorosis of peanuts in Georgia.

Location	Collection date	"Yellow" locations: Number samples	"Yellow" locations: Number Criconemoides	"Yellow" locations: Av.	"Green" locations: Number samples	"Green" locations: Number Criconemoides	"Green" locations: Av.
Laurens Co. terrace	Sept. 5	16	8735	546.	8	126	16.
	Sept. 25	16	983	61.	8	77	10.
Laurens Co. -3 fields	Sept. 25	30	4984	166.	16	345	22.
Jefferson Co. -1 field	Sept. 25	10	4049	405.	4	92	23.
Total		40	9033	226.	20	437	22.

On September 5, stakes were set in this field so that for each four locations on the "yellow" there were two locations well over on the "green" terrace. This arrangement was replicated four times, staked rows being located 50 feet apart. Sample peanut root stools were then lifted from each of three rows next to each stake, and the adhering soil was combined as one sample. After coarse screening and mixing, a 600-ml. sample was processed by the Baermann technique. A total of 8735 specimens of Criconemoides was obtained from the 16 samples, of 600 ml. of soil each, processed from the "yellow" locations, or an average of 546.0 per location. A total of only 126 specimens of Criconemoides was obtained from the 8 samples, of 600 ml. of soil each, processed from the "green" locations, or an average of 15.8 per location. This is a ratio of 34.6 to 1.

On September 25 a single plant was collected at each staked location and processed in the same manner. Only 983 Criconemoides were found in the samples from the "yellow" locations and 77 from the "green", a ratio of 12.7 to 1, somewhat less than the former sampling.

Similar collections were made on September 25 on two more fields in Laurens County and one in Jefferson County. The total for all the collections on this date was 9033 Criconemoides from 40 samples from "yellow" peanuts, and 437 from 20 samples from "green" peanuts. This is a ratio of more than 19 to 1. Counts were made of other species of nematodes encountered in the sampling, but differences in the numbers found could not be correlated with chlorosis of the peanuts.

It may be concluded that Criconemoides shows a major association with "peanut yellows" although other factors may be involved.

COASTAL PLAIN EXPERIMENT STATION, TIFTON, GEORGIA

AN ANTIBIOTIC SUBSTANCE TOXIC TO XANTHOMONAS PRUNI PRODUCED BY ASPERGILLUS NIGER

Mirjana Mirić[1] and John C. Dunegan[2]

On July 28, 1952, we observed a clear zone surrounding a colony of Aspergillus niger v. Tiegh.[3] developing as a contaminant on a petri dish culture of Xanthomonas pruni (E. F. Sm.) Dows. This bacteria-free zone surrounding the Aspergillus colony immediately suggested the production of some antibiotic substance and pure cultures were obtained from this colony of the fungus for further study.

In the first experiments the fungus was grown for 72 hours on beef-extract broth plus 2 percent dextrose and then removed by filtration. Drops of the filtered broth were used to saturate filter-paper discs centered on the surface of petri dish agar cultures heavily seeded with X. pruni. The bacteria were allowed to develop for 72 hours and at the end of this period covered the surface of the agar with a yellow mass of bacterial growth except in a zone surrounding the treated filter-paper discs (Fig. 1, A).

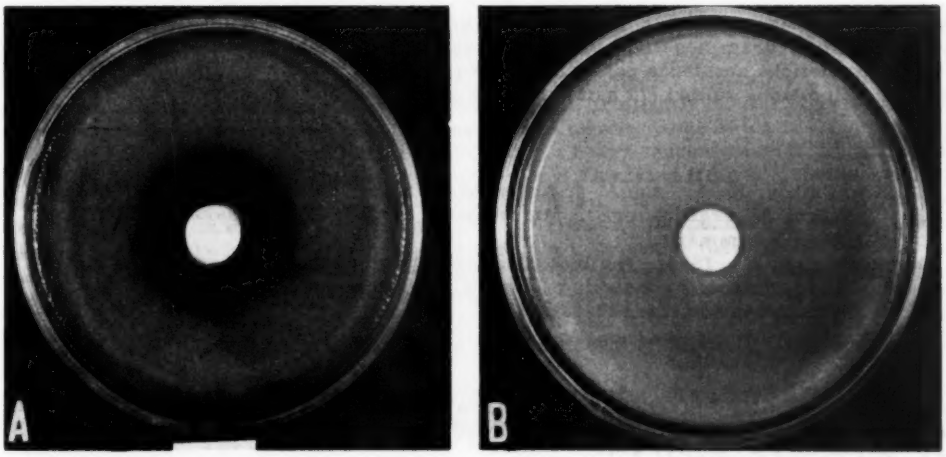

FIGURE 1. A: Clear zone in culture of Xanthomonas pruni surrounding paper disc moistened with filtrate from beef-extract broth plus dextrose that had been inoculated with Aspergillus niger. B: Disc moistened with filtrate from non-inoculated broth which has no retarding effect upon growth of Xanthomonas pruni.

No cleared zone (Fig. 1, B) developed in the controls (filter-paper discs moistened with non-inoculated but filtered beef-extract broth plus dextrose). Similar results were obtained when Czapek's solution was substituted for beef-extract broth.

In another series of experiments, non-inoculated broth tubes and those inoculated with A. niger were heated in a bunsen flame for a few seconds or were held in boiling water for two minutes. In all cases, drops of heated broth filtered from the inoculated cultures produced cleared zones around the treated filter-paper discs centered on agar cultures of X. pruni. Drops of the heated but non-inoculated broth had no effect upon its development.

More precise tests, involving the use of a constant temperature bath and an autoclave,

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[3]The authors are indebted to K. B. Raper of the Northern Regional Research Laboratory, Peoria, Illinois, for the identification of this fungus. He stated that this particular isolation appeared to agree very closely with the original description of the fungus by van Tieghem.

showed that the antibiotic properties of the substance were not destroyed by exposures to temperatures of 66° to 70° C. for 40 minutes or to 110° C. for 10 minutes.

When the fungus was allowed to grow on beef-extract broth for 1, 2, and 3 weeks there appeared to be some evidence of increased activity from the filtrate, but this was not clearly determined in these preliminary experiments.

Cultures held at approximately 5° C. for three months retained their ability to retard the development of the test organism.

These experiments indicate that A. niger produces in culture a substance that inhibits the growth of X. pruni, a gram-negative bacterial plant pathogen. The substance is thermostable, is formed within 72 hours when the fungus is grown on beef-extract broth plus dextrose or on Czapek's solution, and does not become less active as the cultures age. Earlier investigators, Krasilinikov and Korenyako (1) and Stanley (2), obtained similar effects on a number of different bacteria with various strains and species of Aspergillus.

Zaključak

Aspergillus niger v. Tiegh. pri porastu u govedjem extract-u + 2% dextrose-e i u Czapek-ovom rastvoru obrazuje antibiotičku substancu toksičnu za Xanthomonas pruni (E.F.Sm.) Dows. gram-negativnu bakteriju-izazivača biljn bolesti.

Ova antibiotička supstanca pokazala se otporna prema nekim višim temperaturama. Obrazuje se u mladoj kulturi (72 sata) ali se ne gubisa starošću kulture.

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A LARGE-SCALE METHOD OF INOCULATING GRAPES WITH THE BLACK ROT ORGANISM

Herbert C. Barrett

Inoculation of large numbers of plants in the greenhouse has been found desirable in the work with grapes at this station, where breeding for resistance to black rot, Guignardia bidwellii Viala & Ravaz is one of the objectives of the program on improvement of grape varieties. Asci on overwintered mummies yielded insufficient quantities of viable inoculum, and pycnospores from cultures of the fungus also gave generally unsatisfactory results. Atmospheric conditions suitable for infection were hard to maintain in the conventional chambers. Infections have resulted in humidity chambers enclosed by glass, cotton netting imbedded in cellulose acetate, or parafinned cotton cloth, if the air was kept saturated by means of atomized water. However, infection in these chambers was often erratic because of excessive condensation and evaporation during periods of darkness and sunlight, malfunction of atomizers due to insufficient lift after water levels in containers had dropped, and stoppage of nozzles. To overcome these difficulties and to lessen the considerable time and labor involved, a successful method was devised to simplify inoculation in quantity.

Inoculum of Guignardia bidwellii was prepared in this manner. Recently infected grape leaves of susceptible clones in the vineyard and in the wild were picked and placed in polyethylene plastic bags. In the area of central Illinois abundantly infected leaves for the source of inoculum can usually be obtained about the middle of June or slightly earlier depending upon weather conditions. Care was taken to pick leaves with an abundance of lesions and pycnidia over a large part of the leaf surface in order to obtain a heavy concentration of pycnospores. The heavily infected parts of the leaves were cut out and separated from noninfected or lightly infected leaf tissue; then they were cut into small pieces and fragmented further in a Waring blendor. Each batch in the blendor consisted of approximately 100 grams of tissue in 250 ml. of distilled water. The blendor was allowed to run only long enough (usually about one or two minutes) to reduce the small leaf pieces to a mass of fine fibers, thus facilitating the liberation of the pycnospores in the liquid. The resulting mixture of finely cut leaves, plant juices, and distilled water was allowed to stand for five minutes and then filtered by gravity through two double layers of cheesecloth to remove the leaf fragments from the liquid containing the spores in suspension.

Grape plants were inoculated by spraying the spore suspension on the foliage with a De Vilbiss No. 15 atomizer or a small paint spray gun attached to an air line under approximately 15 pounds pressure. The inoculum was fed to the atomizer or paint spray gun by means of a short piece of rubber tubing attached to the intake and extending into a 3-liter beaker containing the inoculum, which was stirred continuously during spraying to keep the pycnospores in suspension. The foliage of all plants was atomized thoroughly until all portions were dripping wet.

Previous to inoculation the plants to be inoculated were assembled in a compact area in a light wooden framework constructed to support a muslin cover in such a manner that the cloth would be 18 inches above the greenhouse soil level and parallel to the perimeter of the assembly area. Immediately after inoculation a layer of unbleached cotton muslin was placed over the wooden framework to enclose the chamber completely. The muslin was sprinkled lightly with a hose and another layer added in the same manner. This was repeated until six layers of wet muslin enclosed the inoculated plants. The muslin-covered chamber was sprinkled lightly several times during the incubation period of 48 hours to keep the surface area moist, and the muslin was then removed.

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RESURVEY FOR EUROPEAN LARCH CANKER IN THE UNITED STATES

Marvin E. Fowler and Kenneth F. Aldrich[1]

A resurvey for European larch canker was initiated in September 1952, with funds provided by the Forest Pest Control Act. This survey is being conducted to determine the effectiveness of previous attempts to eradicate the introduced European larch canker, and to serve as a guide to the continuation of an eradication program. In the present survey it has been established that a few cankers were not found in the earlier surveys and that a few new cankers have developed in the intervening years.

The first discovery in America of European larch canker, caused by the fungus Dasyscypha willkommii, was made in 1927 in Essex County, Massachusetts, on European larch trees (5). In this area many cankers were found on European larch (Larix decidua) and a few were found on Japanese larch (L. leptolepis). These larches had been imported as nursery stock from Great Britian early in the present century. This forest-tree disease has been well known in Europe for many years. It produces destructive trunk and branch cankers and is prevalent in larch plantations in the lowlands of western Europe.

Incipient infections appear as slight depressions in the bark of the stem or branch. On the trunk these depressions may develop until they take the form of a bowl-like cavity. The bark at the edge of cankers frequently cracks and often there is a copious resin flow from the area. The bark falls away on older cankers, exposing the wood. The cup-shaped, whitish fruiting bodies of the fungus commonly develop near the edge of the cankers. These are most conspicuous in wet weather when they expand into saucer-shaped structures of about 1/8 to 1/4 inch in diameter (1).

Following the discovery of European larch canker in Massachusetts in 1927, a search for the disease was made in many exotic larch plantations as far west as the Lake States, but no other infection areas were located. The last of these earlier surveys for European larch canker terminated in 1938, by which time more than 3700 diseased introduced and planted larch in the Massachusetts area had been removed and destroyed by burning. The disease was not found on our native American larch or tamarack (L. laricina) in the area of infection, which is in the border line of the range of this species.

Previous to the discovery of the introduction of Dasyscypha willkommii into the United States, closely related Dasyscyphae were known to be distributed throughout North America as harmless saprophytes. Accordingly it became imperative that the introduced canker pathogen be differentiated from our native fungi. An intensive laboratory investigation carried on at the time at the New Haven, Connecticut, field laboratory of the Division of Forest Pathology, demonstrated that the parasitic D. willkommii was morphologically and physiologically distinct from all other related Dasyscyphae in our northern hemisphere and that from a pathological standpoint the latter were unimportant. These investigations, which supplemented the survey and eradication program, also clarified the exact distribution of the European canker organism in this country (2, 3, 4).

In the present surveys, following a 14-year period in which no surveys were made, abundant fructifications of the foreign parasite have been found on old and new cankers on a very few European larch that had escaped the early eradication program. New infections of D. willkommii were also found on small branches of three additional European larch. The infected trees were promptly cut and destroyed. All cankers collected by the survey crew were submitted for identification to the laboratory at New Haven where they were cultured and determined by Dr. G. G. Hahn.

Our native western larch (L. occidentalis) is reported to be very susceptible to European larch canker when planted in Europe. There the principal damage to larch in plantations is caused by the distortion and weakening of cankered branches and trunks, predisposing them to snow- or wind-break. Control of the disease on European larch in Europe is a silvicultural problem, for larch planted on favorable sites not subject to recurring frost damage maintain their vigor and are not seriously injured by this disease. Native larch in the United States, both in the East and West, often occur on sites considered below the optimum for best growth.

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[1]Respectively, Senior Pathologist and Biological Science Aid, Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture.

There is accordingly the probability that these may be severely affected should the larch-canker organism become established in our native larch stands.

Surveying for larch canker is a difficult and tedious task. Incipient cankers are not only small but may occur on the upper side of branches of large trees, and it is impossible to detect them from below. To make sure that cankers of this type are not present, it is necessary to climb trees and scrutinize all branches carefully. Such a survey is now underway in Essex County, Massachusetts. European larch plantations in other sections of the State and in other States, as well as tamarack in the canker-introduction area, must also be inspected to insure complete eradication.

The presence of Dasyscypha willkommii on only three newly infected European larch among thousands recently inspected in the Massachusetts area, indicates a high degree of success in previous attempts to arrest the spread of this foreign disease. This fact lends encouragement to the belief that European larch canker may be prevented from spreading to our planted and native larch stands.

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DIVISION OF FOREST PATHOLOGY, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, UNITED STATES DEPARTMENT OF AGRICULTURE, BELTSVILLE, MARYLAND

EFFECT OF TIME AND TEMPERATURE ON ISOLATION OF THE OAK WILT FUNGUS FROM INFECTED TWIG SAMPLES

T. W. Bretz and David W. Morison

During 1952 difficulty was encountered in isolating the oak wilt fungus (Endoconidiophora fagacearum) from specimens collected in the Missouri-Arkansas area. The method of sampling the suspect trees, care of the samples after collection, and the isolation techniques were the same as those used in previous years. The percentage of oak wilt infection confirmed by laboratory culturing of suspect material, however, was substantially lower than in 1950 and 1951. Some of the unconfirmed trees were unquestionably infected. Whenever possible, re-collections from such suspect trees were obtained for additional culturing, and the fungus was recovered in some instances, thereby confirming the field diagnosis. It was felt, however, that the extremely high temperatures that prevailed in the area during the summer may have been a factor, either directly or indirectly, in accounting for this low percentage of laboratory confirmations. Conceivably such temperatures might have affected the survival of the fungus in the small diameter wood in the standing tree, or the organism may have died out in the samples between the time of collection and isolation. Often three to six days elapsed between the time the samples were collected and their arrival at the laboratory.

A preliminary study has been made on the survival of E. fagacearum in small-diameter specimens held at different temperatures for varying lengths of time after collection. Twig and branch material was collected in September from throughout the crown of a known wilt-infected tree. This was cut into 6-inch lengths and thoroughly randomized so as to eliminate the probability of any given sample containing material from the same part of the crown. The material was divided into three diameter classes: under 1/4 inch, 1/4 to 1/2 inch, and 1/2 to 3/4 inch. Wrapped (in waxed paper) and unwrapped samples of four-twig sections each were prepared from each diameter class and stored at 0°-5°, 6°-10°, 20°-25°, 30°, and 35° C. Enough samples were prepared so that a new sample for isolation was available in each diameter class, wrapped and unwrapped, from each of the five storage temperatures, for the duration of the study. The first isolations were made three days after collection of the material and at three-day intervals thereafter for a period of 27 days. The standardized technique for the isolation of the fungus was used. The medium was malt agar.

Throughout the duration of the study all samples stored at 0°-5° and 6°-10° C. yielded the fungus at each isolation date. The fungus was recovered from all samples stored at 20°-25° the third and sixth days after collection. On the ninth and twelfth days after collection, it was recovered from material held at this temperature only from the 3/4-inch wrapped specimens. Thereafter, the fungus was recovered from an occasional specimen through the twenty-first day. At 30° the fungus was viable in all samples through the sixth day, but not thereafter. There was no recovery of the fungus after the third day in any of the samples stored at 35°.

These results indicate that the survival of E. fagacearum in small-diameter material is relatively short at temperatures of 20°-25° C. and above. There were no significant differences in the recovery of the fungus from the wrapped and unwrapped samples. The growth of surface contaminants was profuse on the wrapped specimens held at 20°-25° and above, which necessitated special handling of these samples prior to isolation. It was also noted that, as the time interval between collection and isolation became greater, the development of secondary organisms from the wood chips in the culture dishes made from material stored at 20°-25° and above became greater.

It would appear, on the basis of these preliminary results, that time and temperature are the critical factors in handling oak wilt twig samples. It is quite probable that some samples collected in the summer of 1952 were subjected to temperatures of 35° C. (95° F.) and above for a sufficiently long period after collection to have resulted in the death of the fungus. It seems desirable, thereafter, that, when laboratory confirmation of suspect oak wilt trees is essential, specimen material should reach the laboratory as quickly as possible. Exposure to high temperatures should also be avoided in so far as possible. If specimens reach the laboratory promptly and are not subjected to high temperatures, it should be possible to recover the oak wilt fungus more readily and there should be less difficulty from secondary wood-invading organisms.

As an adjunct to the above study, samples of oak-wilt infected twigs were stored in a deep-freeze unit immediately after collection. Isolations have been made from this material at approximately monthly intervals and the fungus was still viable and recovered in culture

three months after collection. Under such conditions it appears that material for culture purposes might be held indefinitely.

DIVISION OF FOREST PATHOLOGY, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, IN COOPERATION WITH THE MISSOURI AGRICULTURAL EXPERIMENT STATION, COLUMBIA, MISSOURI

AMERICAN CHESTNUT SUSCEPTIBLE TO OAK WILT FUNGUS

Raymond A. Ernst and T. W. Bretz

The American chestnut (Castanea dentata) is susceptible to the oak wilt fungus (Endoconidiophora fagacearum) when artificially inoculated under greenhouse conditions.

Vigorously growing, potted, two-year-old C. dentata seedlings, obtained from a West Coast nursery, were inoculated by hypodermic injection with a heavy spore suspension of the oak wilt fungus. The inoculum was prepared from a number of isolates obtained from a variety of naturally infected suscepts from a wide geographic area and contained strains of opposite compatibility types. Typical oak wilt foliage symptoms, beginning in the leader and at the branch terminals and progressing inward and downward through the crown, developed 44 to 81 days after inoculation in 6 of 8 trees inoculated. Sapwood discoloration accompanied the leaf symptom development and some trees developed basal sprouting prior to death.

The fungus was recovered from all trees that developed wilt symptoms. One of these isolates developed fertile perithecia when grown alone on chestnut agar, indicating that a mixture of compatible strains was recovered in this instance.

A number of trees of the same stock, grown out of doors under nursery conditions, were inoculated in mid-July and again in mid-September. Only one tree developed symptoms suggesting wilt infection prior to the onset of fall leaf coloration in October. The oak wilt fungus was recovered from this tree. Isolations from a number of inoculated trees that had shown no distinct wilt symptoms failed to yield the fungus. The results of the inoculation of the nursery stock, therefore, are inconclusive.

DIVISION OF FOREST PATHOLOGY, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, U. S. DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE MISSOURI AGRICULTURAL EXPERIMENT STATION.

UNUSUAL NUMBERS OF SPOROPHORES OF A WOOD-ROTTING FUNGUS ON TRUNKS OF POPULUS TREMULOIDES VAR. AUREA

Paul D. Keener

In the arid Southwest, the formation of externally observable sporophores on living trees by species of wood-rotting fungi is of interest because of their relatively infrequent occurrence in specific areas. The northern part of Arizona (i.e., north of the Mogollon Rim) is of generally higher elevation than the central and southern valleys. It is in this area that much of the ponderosa pine, fir, and aspen occur. North of Flagstaff, in the region known locally as the "Snow Bowl" or Winter Sports Area, and located in the San Francisco Mountains, there are rather extensive groves of Populus tremuloides Michx. var. aurea (Tides.) Dan., the main aspen species common to the State. A recent trip into this area disclosed trees with from one to numerous conks of a wood-rotting fungus, on trunks (Fig. 1-3, inclusive). Conks were observed near ground-level as well as high on the trees. Many of the conks appeared to originate at points where natural pruning of lateral branches had occurred. The fungus was identified as Fomes igniarius (L. ex Fr.) Kickx (Fig. 4). Since many of the trees appeared to have unusual numbers of conks (Fig. 1, 2), random counts were made. Counts were also made at another location in the same general region, i.e., one mile from Hart's Prairie on the Snow Bowl road.

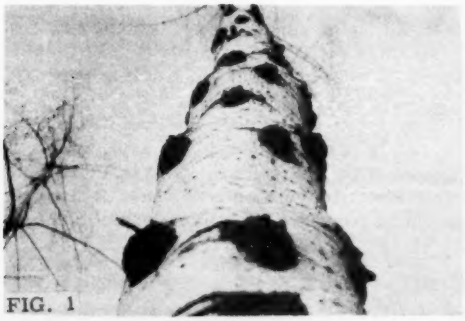
FIG. 1

FIG. 2

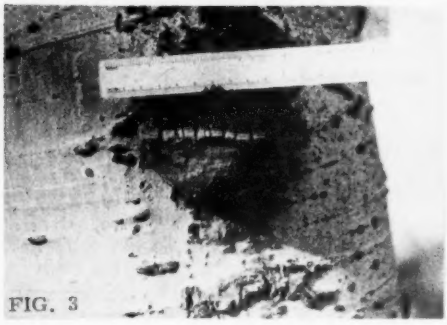
FIG. 3

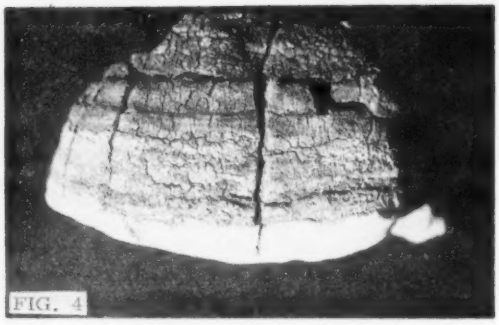
FIG. 4

FIGURES 1-4. Sporophores of Fomes igniarius (L. ex Fr.) Kickx on Populus tremuloides Michx. var. aurea (Tides.) Dan. (All photographs reproduced from 35 mm. kodachrome transparencies.)

1 -- Numerous conks on trunk of tree located at Summerhaven, Santa Catalina Mountains, north of Tucson (Southern Arizona).

2 -- Several conks on tree located near Hart's Prairie, near Flagstaff (Northern Arizona).

3 -- Single conk of the fungus on aspen located at Snow Bowl, near Flagstaff.

4 -- Single conk (enlarged view) of F. igniarius showing the sporophore surface characteristics.

Table 1. Numbers of sporophores of F. igniarius per aspen tree at three locations in Arizona.

Tree	Numbers of sporophores observed with unaided eye		
	Northern Arizona		Southern Arizona
	Flagstaff - Snow Bowl	Hart's Prairie	Summerhaven Santa Catalina Mts.
A	9	11	23
B	13	0	42
C	40	6	
D	9	24	
E	20	11	
F	2	7	
G	13	6	
H	13		
I	11		
J	12		
K	8		
L	19		
Approximate average numbers	14	9	32

In southern Arizona, elevations above sea level are somewhat less, except in cases where high mountains arise from the floor of the desert valleys. Such mountains also support the growth of pine, fir, juniper, and some aspen. At Summerhaven on Mount Lemmon (part of the Santa Catalina Mountains) north of Tucson, sporophore counts were made from two trees. The results of all counts from the three locations indicated are given in Table 1.

DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF ARIZONA, TUCSON

UNUSUAL RECORDS OF PLANT DISEASES

FLYSPECK OF APPLE IN CALIFORNIA

By Richard D. Durbin and William C. Snyder

Flyspeck, incited by Microthyriella rubi Petrak (Leptothyrium pomi (Mont. & Fr.) Sacc.) (2), has been identified on apple, varieties Double Red Delicious and Newton Pippin, in the Valencia district, near Aptos, Santa Cruz County. This is believed to be the first report of flyspeck on apple occurring in California.

The symptoms on the fruit appear as smallish, black, semi-circular specks which are superficial on the cuticle. Usually the specks occur in randomized groups; infrequently, however, they may be irregularly distributed over large areas of the apple. Economic losses have ensued because the specks are not easily removed from the fruit by the use of current handling practices. In culture a slow growing, gray, compact mycelium characteristic for this fungus (1) was isolated.

Farm Advisor Edward C. Koch made the first collections of the disease, and has reports of its occurrence for the previous year, 1951. Although limited, his observations indicate that flyspeck is of serious consequence in this district.

In some parts of this coastal region the frequent summer fogs maintain the humidity at a high level for intervals of several days and at times may result in the formation of free water by condensation. It is thought that these periods of high humidity, along with suitable temperatures, account for the local occurrence of the disease, since its appearance in eastern areas has been typically associated with summer rains.

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DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA

EPIPHYTOTIC OUTBREAK OF SIGATOKA DISEASE AT TINGO MARÍA REGION, PERU[1]

By Javier Diéguez C.[2]

In 1946 the Department of Plant Pathology and Entomology at the Agricultural Experiment Station in Tingo María, Peru, reported the presence of Sigatoka Disease of bananas, caused by Cercospora musae Zimm. At that time the disease was appearing sporadically in plantations on soils of low fertility.

At the same time, however, growers were being encouraged by the quick and substantial returns obtained from bananas grown on good soils of the region; and extended their plantations regardless of the soil type, many of them using even hilly, acid, and otherwise poor soils. Warnings against such indiscriminate expansion went generally unheeded. Today of the approximately 3000 acres in the Tingo María region planted to bananas, a considerable proportion is not well-suited to the crop.

Since 1950 the disease has spread rapidly from banana plantations on poor locations to those on good ones. Young plantations are proving just as vulnerable as the old, undoubtedly because the fungus has increased in virulence during the six years of its activity in the area, at the same time that the good soils have lost fertility. In fact, excellence of soil conditions no longer seems to deter the fungus.

The disease, together with competition from plantations in the northern part of Peru, has reduced the market price of a finger (banana) from 0.5 U.S. cent to approximately 0.2 cent, making it uneconomical to produce bananas in the Tingo María region.

Control of the disease with Bordeaux mixture, with either fixed or portable sprayers, is too expensive to be practical. The cost of the copper sulfate alone is enough to make the treatment prohibitive: for one hectare it would come to $200, almost as much as a hectare will yield when market prices are good and the planting is healthy.

The Experimental Station at Tingo María, through the Peruvian Department of Plant Sani-

tation, is planning to test the effect of treating banana plants with several minor elements. It is hoped that some of these elements will make the plants resistant to the disease. If the treatment proves successful, it will be within the means of even small growers, for it will cost less than 66 dollars (about 1,000 Peruvian soles) per hectare, including the cost of materials, equipment, and labor.

ESTACIÓN EXPERIMENTAL AGRÍCOLA, TINGO MARÍA, PERU

[1]A contribution from the Estación Experimental Agrícola, a technical agricultural service organization for Peru operated jointly by the Government of Peru and the Office of Foreign Agricultural Relations, U. S. Department of Agriculture. United States participation in this work is being carried out as part of the Point IV program in Peru, administered by the Technical Cooperation Administration, U. S. Department of State, through the Institute of Inter-American Affairs.

[2]Ing. Diéguez is a member of the staff at Estación Experimental Agrícola.

CURLY TOP ON POTATOES IN CALIFORNIA

By N. J. Giddings

In August 1952, I found curly top (Ruga verrucosans) quite prevalent (8 to 10 percent infection) in a field of potatoes being grown for certified seed stock near Rosamond, California. In September collections were also made by Dr. Robert Flock of the Citrus Experiment Station and I obtained curly top virus from most of his specimens. In September we found curly top in another large field near Tehachapi. We estimated the amount at about 8 to 10 percent.

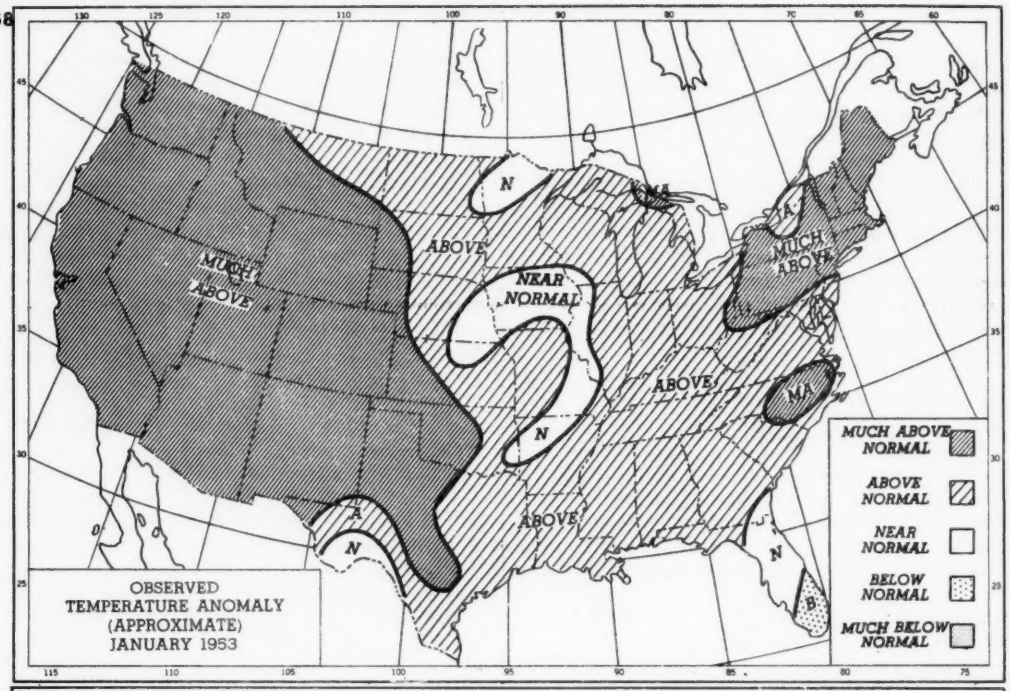
The manager of the Seed Potato Growers' Association estimated reduction in value of the potatoes from those two fields at around $15,000. That is because they could not be sold as certified stock.

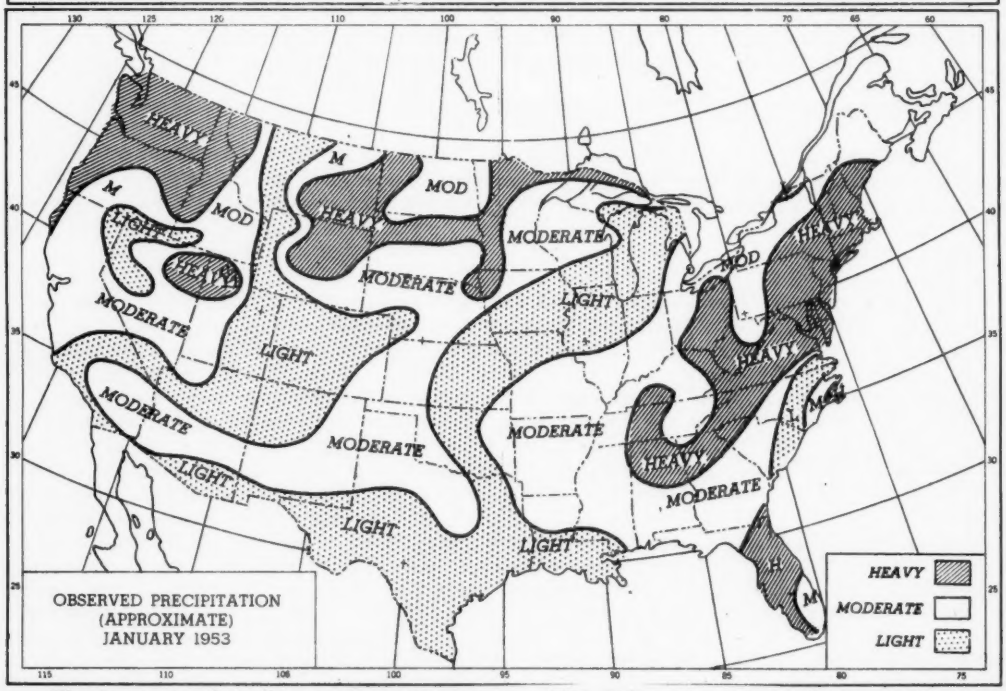
Curly top virus was also obtained from okra plants near Rosamond.

DIVISION OF SUGAR PLANT INVESTIGATIONS, U. S. BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, RIVERSIDE, CALIFORNIA

A CORRECTION

Our attention has been called to two errors in the article by J. W. Heuberger and P. L. Poulos on control of apple fire blight and leaf spot in the preceding issue. In the summary on page 82, the final sentence should read: Of the antibiotics, thiolutin (at 120 p.p.m.)...etc.





The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted. P. R. M.